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THE ARMY ORDNANCE ASSOCIATION

The Aims, Purposes, and National Officers of the Society

THE Army Ordnance Association, a national society of more than 14,000 American citizens, was founded in 1919, "pledged to industrial preparedness for war as our nation's strongest guaranty of peace." The society was incorporated under the laws of the District of Columbia in 1928. Its entire energies are now dedicated to victory for the armed forces of the United States. For the duration of the war it is "pledged to victory—complete, absolute, final."

The Association has endeavored during the past twenty-three years to keep alive an interest in and knowledge of the design, production, and maintenance of military armament. This it has done through periods of public lassitude and times of great national emergency. Until 1940 there was no peace-time armament industry in the United States for the production of ordnance. Now all American industry is being geared rapidly for victorious war production.

The principal objective of the society is an active membership of American citizens to assist in the design, development, procurement, production, maintenance, and supply functions of the Ordnance Department of the United States Army. When peace returns, this body of informed citizens will again continue to be a bulwark of knowledge, experience, and ability upon whom the Armed Forces of the United States can rely for technical and scientific assistance and for industrial preparedness.

The Association is devoted solely to the national defense; it has no commercial interests, no political alliances, and no religious affiliations. It is not operated for profit: its income is expended in furthering its aims. Its elected officers and directors serve without remuneration. Membership, to which American male citizens are eligible, is four dollars a year. (Application facing p. 316.) There are twenty-one local chapters of the Association throughout the United States.

ARMY ORDNANCE, the journal of the Association, is published solely for the purpose of disseminating information on the progress of our munitions developments so that American industry may at all times know its responsibilities to the common defense.

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To assist in effecting industrial preparedness for war as being one of the nation's strongest guaranties of peace;

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To provide, when required, the services of competent committees to investigate and report upon special ordnance subjects;

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To commemorate the services rendered by the industry of the nation and by the officers and civilian employees of the Ordnance Department in the wars in which the United States has been engaged.

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U. S. Navy

In Convoy

ARMY ORDNANCE

Volume XXIV MARCH-APRIL, 1943 No. 137

America Is Ready

Our New Army Is Trained and Equipped for Modern Combat

Henry L. Stimson*

I GET a great deal of encouragement as I survey what has been done and what we started from 2½ years ago when I first came in contact with the Army and saw what was then in existence. In July 1940, our Regular Army consisted of only 265,000 men, including an Air Force of 50,000 men with only 2,175 pilots. We had a National Guard somewhat smaller than the Regular Army, consisting almost altogether of small units in the different states. Only a very few states had units as large as a division; most of them were companies and regiments.

Neither the Regular Army nor the National Guard was organized in tactical units of the size at present being used in modern warfare. We were just beginning to do that in the Regular Army, and we didn't even have the power to order out the National Guard in a manner to give it full training. None of our forces were trained in the methods of modern combat but merely in the elementary steps of the old-fashioned warfare of twenty-five years ago. We were only just beginning to experiment in the first steps of tank warfare, and only a very few of our officers—comparatively a very small percentage—had had experience in any war. In other words, the Government was in the position a football coach would be in at the beginning of the season if he found he had only a mass of men, the bulk of whom had never even played football and the few who had played it had only played soccer.

We had practically no equipment—no equipment in bulk, I mean—except the leftover stores from the last war, and those weapons that came over from the last war were types which were rapidly being left behind by the progress of the new war. We had almost no weapons in existence which we would use today either in the shape of planes or tanks or artillery, and we had comparatively few in the shape of small arms—only our Springfields and some machine guns and a few smaller things. That was not the fault of our Regular officers or our General Staff. They had faithfully laid plans for modern organization of our forces, including the acquisition of planes and other weapons fit for this new kind of warfare that was beginning, but until the fall of France neither Congress nor the people of the United States were at all willing to incur the expenses of any such preparation.

I can give you one very sharp example that fell to my notice almost as soon as I got here. Probably the most fundamental weapon of all modern warfare is powder, and when I came here in July 1940, we didn't have enough powder in the whole United States to last the men that we now have overseas for anything like a day's fighting. And, what was worse, we didn't have any powder plants or facilities to make it; they had all been destroyed after the last war. The criticism which had then arisen against "merchants of death," as the commentators called powder manufacturers, had resulted in such unpopularity that the greater part of the powder makers had gone out of business. Some of them, I know, had spent a great deal of money destroying their plants. I remember that the first few weeks I was here I went around like Israel Putnam was said to have done in the beginning of the Revolution crying, "Powder, powder, for God's sake give me powder!" because it takes about two years to construct and get a large-sized powder plant into full operation. The same thing was practically true of our facilities for the manufacture of weapons: We had no facilities for manufacturing weapons except our six little Government arsenals whose capacity is only five per cent of the facilities we have today.

THESE words of the Secretary of War come as a stimulating and inspiring message to all Americans in this crucial period of our history. A little over two short years ago our military establishment had serious shortages in men and matériel: In 1940 our Regular Army numbered only 265,000 men; there were only small numbers of up-to-date airplanes, tanks, and artillery; there were practically no powder plants or facilities. This deplorable state of unpreparedness had been forced upon the country by thoughtless or deliberately malicious criticism of "munitions makers," as Secretary Stimson points out.

But today, the picture is encouraging. America, confronted with the greatest task in its history, buckled down and proceeded to do the impossible. Today, the Army numbers over 5,000,000 highly trained men and is still expanding, and there are huge supplies of the finest fighting equipment. In 1942, American industry, in answer to the plea of its Commander in Chief, produced 48,000 airplanes, 56,000 combat vehicles, 670,000 machine guns, 21,000 antitank guns, 10,250,000,000 rounds of small-arms ammunition, 181,000,000 rounds of artillery ammunition.

But this is only a beginning. Secretary Stimson's clear analysis of our shortcomings and their solution will inspire American man power and American industrial strength to even greater achievements in 1943 and will imbue them with a high resolve that our armed forces never again shall be rendered impotent for lack of arms and men.—EDITOR.

*The Secretary of War.

In the next place, we had no legal power to increase and train an army of the size required by modern warfare. Such an army can only be raised by compulsion in any country. We had no selective-service law, and that meant that in case we had to raise an army hastily we would be practically helpless. We had no power, as I said before, to order out the National Guard for a year's training until we got it in the middle of that summer. We didn't even have the right to sell weapons—the weapons that we did have—to other countries who were fighting for us, except under restrictions that made it very difficult.

I MENTION these things because they are striking examples of the mental unpreparedness of our nation at that time. The United States was still a great, peaceful, helpless nation with its mind and its industries geared solely to an economy of peace and unpreparedness for war, and its people were still dominated by an unthinking philosophy of isolationism. That was less than 2½ years ago.

What have we today? We have an Army of over 5,000,000 men, of which well over 1,000,000 constitute the Air Force, including literally tens of thousands of pilots—I won't say how many tens of thousands because I am told that is a military secret. We thus have today nearly twenty times as many soldiers as our whole Regular Army had in 1940. It has been raised by the most fair and scientific system of selective service this country has ever had. You have only to read of the draft riots of 1863 to realize what trouble can come from an unscientific system of selecting soldiers for the nation.

We are rapidly training the officers of these forces who are chosen by the most democratic method and educated by the most thorough system of officer schools we have ever had in our history. When I say democratic, I mean we insist that every combat officer shall have had at least three or four months' experience in the ranks. When I speak about the thoroughness of our schools, I refer to what practically every visitor who goes to those schools—and who comes afterwards to tell me about his experiences—impresses upon me as the most important thing he has seen: All say that the system is magnificent in its thoroughness and in the intensity of its spirit. The people who made those observations have been of so many backgrounds that I have been very much impressed by them.

OUR Army is being organized into units, equipped and trained in such tactical units, and prepared for the dangers of disease and battle before it leaves these shores. This is being done in the most careful way that an American army ever has been trained in our history. Furthermore, each particular unit is being trained for its particular task abroad as far as that task can be foreseen. Its training is thus tied up with our strategic plans. I have only to refer you back to a situation that we had in the last war to see the immense difference that this means. Then, we had no units organized in this country higher than a division. In the last war any units higher than a division were all created abroad, and all that our training did was partially to prepare these divisions in this country and then send them abroad in that imperfect condition to be trained on the field of battle. I remember of my own knowledge that in some divisions men were being sent into the trenches who had only ten days of rifle shooting. Yet those divisions fought in the Meuse-Argonne and by so doing virtually were a predominant factor in shortening the war.

Turning from training to equipment, this Army of ours is being rapidly equipped with the best airplanes that are in the air today, with the best tanks that are on the ground today, with the best self-propelled artillery that is in action today, and with the best rifles, according to almost unanimous testimony, that are in use in any part of the world today—and its other equipment is of a similar high standard.

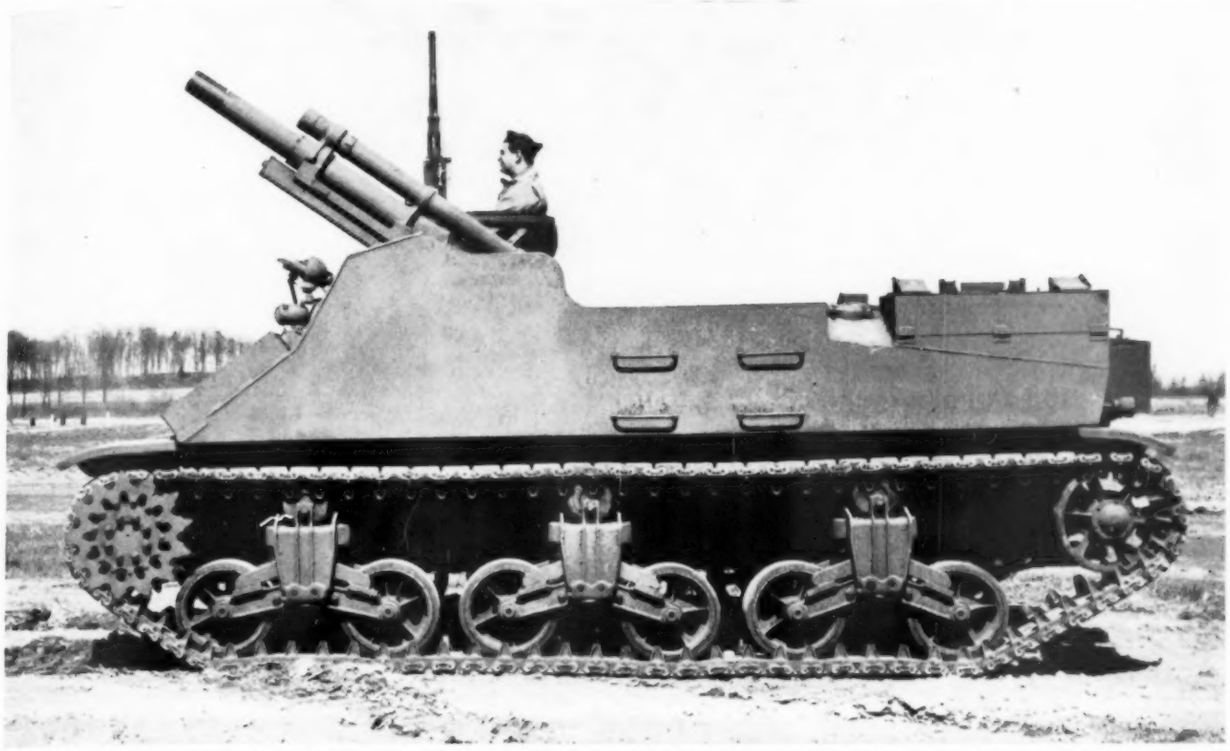
This Army is being trained with more solicitous care for its health, its physical condition, its mental and its moral welfare than any former American army in our history. That is a fact that I am very glad to emphasize for the benefit of the parents and families who write me in solicitude for their sons who have gone into the Army. The soldiers we have are worthy of this care—we would be derelict if we did not give it. We often hear and read criticism of the general bad health of our nation and of its deficiency in teeth, eyes, feet, diet, and other particulars, not to speak of morals. I have been looking over the standards of our soldiers of the Army of 1942, as revealed by statistics of the research branch of our Special Service, and they show quite a different story as far as the Army is concerned.

THE average American soldier of today weighs about eight pounds more than the soldier of 1918. The percentage of our soldiers today who are graduates of high schools is more than three times the percentage of such graduates in 1918. The average soldier of today is a sober man. Over fifty per cent confine themselves to soft drinks entirely, only about forty per cent drink beer, and only the very small remainder —less than ten per cent—drink distilled liquor. He is moral; he attends the churches we have built for him at the different camps. The percentage of our soldiers who go to those churches today is much larger than the percentage of our male citizens outside the Army who go to their own churches.

He is a healthy man. The general disease rate is lower than in any previous war, and the same is true of the ratio of venereal disease. Not only is the health of these men being solicitously guarded and their bodies toughened and hardened by every variety of violent exercise, but upon this pedestal of sound physique we are trying to place the indispensable moral qualities which must go with the fighting American soldier. We are combining education with recreation; we are providing for religious and spiritual well-being.

We are furnishing our soldiers with every element which tends to produce what the old Roman motto called *Mens sana in corpore sano*—a sound mind in a sound body. Whereas in respect to their fighting equipment and to the methods and tactics of using that equipment we are seeking to give them the very last word in all that science and invention can produce, in their mental and moral training we are not seeking new gadgets—modernistic try-outs. We are seeking to build up in them the long-tested elements of character which have distinguished their fighting American forefathers in the past—courage and fortitude employed with intelligence and directed by character and consideration of others; bravery without brutality; confidence without arrogance. This is based upon our belief that a high standard of intelligence, education, and character is quite consistent with valor in the supreme test of war.

We believe that in our new Army we have many young men quite fit in character and standards to emulate the imperishable tradition set by the best American soldiers of our history. That the training we are giving them is bearing the



TYPICAL OF THE ARMY'S NEW EQUIPMENT IS THIS 105-MM. HOWITZER ON SELF-PROPELLED ARMORED MOUNT

intended fruit and is not going to make them soft is shown by evidence which is now coming in from the battlefields of every portion of the world. These men are going fresh from the training fields into the intolerable climate of the jungles of New Guinea and Guadalcanal and are outfighting there the race from Japan which has devoted six centuries to the training of its soldiers—for six centuries the soldier of Japan has been the dominant man in the community. In the same way our men are going fresh from our training fields to meet in the air the veteran fighting pilots of Germany, and statistics show they are outfighting them.

We also have just seen them execute in Africa the most difficult and dangerous task of all warfare—landing upon a hostile coast in the teeth of the fire of veteran troops—and do it with the most perfect precision of timing and planning which brains and courage have ever carried out in the history of warfare. I think that is a worth-while contrast and a proof of growth.

IN voicing my satisfaction with the Army's progress, I want you to notice that I am not departing from the Biblical warning I have given you in the past as to the danger of boasting with regard to future events. What I have said relates to matters which are already accomplished. I am not making prophecies; I am speaking only of established facts. Furthermore, these are facts which are not hidden or mysterious but which have taken place in the full light of day and are matters which the citizens of this country can verify through their sons, brothers, and friends in the Army.

As a citizen who is the head of the Department to which this Army belongs, I am proud of the magnificent work which has been done by the Chief of Staff and his associates in the General Staff. These are the officers who have been charged with this vital duty for the nation, which I have been describing. They have wrought well, and I am convinced that the people of this country as a whole know that they have wrought well. Having thus deserved our confidence, I know that it would be of immeasurable value to them in the discharge of their future critical duties to realize that they may rely upon our appreciation of their work.

There will undoubtedly be proposals made during the coming winter which would radically modify or impair their plans; many of these proposals will come from the purest patriotism on the part of those who make them. But it is my view that the decision of vital matters which are intrinsically military in character should remain the responsibility of our trained soldiers. On them rests the stern and exacting task of actual participation in this war with the hazard of life and death for themselves as well as for their country. They are the only people among us who have the training and the information necessary to carry through this responsibility.

For the making of these decisions they have had access to all the facts in the possession of their Government as to our resources, our manufacturing facilities, and our power to transport this Army by sea, land, and air. They have had the benefit of constant conferences with the corresponding military and naval representatives of our great allies. Finally, in all their decisions these men have worked in active collaboration with, and are subject to the full approval of, the constitutional Commander in Chief of the entire forces of our country—the President of the United States. In my opinion, it would be a rash thing for any man without such information and training to challenge their mature decisions. The Army moves into the new year confident and sure of its mission. To date it has done well.

EDITOR'S NOTE.—At his press conference on February 4th, Secretary Stimson said: "On the whole, the military situation is favorable, but there is no ground yet for excessive optimism concerning an early end of the struggle."

The Army Ground Forces

Our Officers and Men Must Be Prepared To Meet a Stubborn Enemy

Lieut. Gen. Lesley J. McNair *

BOTH Germany and Japan are military nations. Comparatively speaking, both always have been at war or preparing for it. They are have-not nations and have no intention of remaining so. Their soldiers of today were born and brought up in the military tradition. The German Army certainly—and the German people probably—never looked upon the Armistice of 1918 as other than just that. There was no question that the war would be renewed, because they would renew it. The only questions were of ways and means, of how and when. The German soldier was born to the goosestep—and do not think lightly of that goosestep, for it is symbolic of the highest and sternest in military training.

German training always has been of the finest, as Americans learned full well in World War I. So extensive and thorough was their military training prior to the present war that it was reported, during the winter of 1939-1940, that they created divisions ready for battle in six months, enabling them to expand their strength enormously during the period just before the fall of France. Their preparations for the opening campaign in Poland were carried out by several diplomatic coups, which involved extensive troop movements together with elaborate maneuvers in the field at home. As a result, the Polish campaign proceeded with clocklike precision and at the same time afforded valuable battle training at a nominal cost. The French campaign of 1940 was prepared equally thoroughly and was conducted so swiftly that enormous results were achieved with lightning rapidity.

In Russia, things have not gone so smoothly for the Germans. The Russians have profited by the fate of Poland and France. Then, too, the great strength of the Red Army, their marvelous fighting spirit, and their sound strategy and tactics have matched the German might. The situation goes to show that, great as is the German Army, the German soldier is no superman; he has a ceiling, even though it is an elevated one.

German training has paid dividends other than victory to German arms. Let us consider the World War figures. The total battle deaths of that war have been stated as roughly eight millions, of which thirty-seven per cent were German and sixty-three per cent Allied. In other words, the Allies lost about seventy-five per cent more than did the Germans. The difference in numbers is more than 1,500,000 men; that is, Germany gained that number of men, as compared with the Allies, as a result of the war. Since the Germans attacked almost continuously on one front or another until near the end of the war, and the attack is more costly than the defense, the difference in battle losses must be attributed to superior German training and leadership. Need we argue as to the need of training?

Let us consider Japan. The modern Japanese Army was built on a foundation of German tutelage, although beyond doubt the Japanese national characteristics and ancient military background afforded the German teachers some very apt pupils. The Japanese have been considered by many—and military men among them—as merely imitators. They do imitate well—too well—those foreign offerings which they decide after deliberation are worth imitating. But, in addition, they originate—diabolically from the military viewpoint. As the first year of our war passes, and the Japanese strategy unfolds, who is there to call it amateurish? If imitations are discovered, they are of sound and proved principles. Their strategy is being shaped precisely to fit Japan's interests—full of boldness, boundless in scope, and deadly in execution.

The training of the Japanese soldier apparently is comparable in thoroughness with that of the German. Like the German, the Japanese troops are war-hardened—in their case by the Chinese War. Their physical stamina is of the highest. Young Japanese-American soldiers now in our Army are displaying physical qualities which Americans must take seriously.

THE Jap is a hard, relentless fighter—a killer. He fights with every available means, including treachery. Apparently he has no fear of death. His fighting tactics are sound and clever. He uses every weapon he has. His clothing, equipment, weapons, and tactics are selected for the task at hand, and resemble European standards only as those suit his needs. He attacks habitually, endeavoring always to encircle his adversary by stealth and speed, or else to filter through openings along the front. His speed on foot in jungle terrain is remarkable. He travels light in everything except weapons and ammunition, although he has the essentials even in small details. He is adept in employing the fire of all kinds of weapons. If his enemy is prone to be roadbound, especially in difficult terrain, he mines or otherwise obstructs the roads, piles up the enemy's transport, encircles him by moving off roads, and then destroys or captures him. It is clear that his skill is the result of training, for the same pattern is observed in all Jap operations. He is equally at home in the jungle, in open country, and in mountains. He is fully abreast of modern technical advances, although he displays a marked preference for simple and rugged equipment, provided that it answers requirements.

These brief descriptions may appear to portray our enemies as admirable—a better word is formidable. We are concerned with bald facts. If the facts are against us, let's change the score—and we can do it. It certainly is both silly and dangerous to kid ourselves into believing that we face a pushover. It is better—and healthier—to hit the dirt now, and get good. Your comrades overseas are learning about their enemies the hard way. You must avoid some of that grief.

All in all, we must admit that the Germans and Japs both have done well by themselves thus far, thanks to thorough, painstaking preparations for years, careful planning, and bold, unscrupulous leadership. The results admittedly have paid no small dividends on the great gamble of these two nations. Our job is to break up the game.

*Commanding General, Army Ground Forces, U. S. Army. From an address to the Army Ground Forces.

Signal Corps

A LIGHT TANK OF THE ARMORED FORCE ON MANEUVERS UNDER BATTLE CONDITIONS

Now let's look at our side of the picture. We are building an army of free men—free because our forefathers made us so. We are a "have" nation. We most certainly are anything but militaristic. We probably are called mercenary, commercial, materialistic, or what not, partly because we are not uninterested in such aspects and partly because we are not military—decidedly not. It is true, of course, that we have military establishments, but they always have been comparatively small, and the citizenry as a whole has been almost entirely unaffected by them. The contrast between us and our enemies, in point of military prowess and background, could hardly be greater. We now are beginning to test our kind of an army against those of our veteran enemies. How are we doing?

AS a generality, an army needs matériel and personnel. Matériel—arms, equipment, transportation, clothing—has given and is giving even our vast industrial system a few headaches, especially on account of aiding our allies, but the matter is being licked. We still lack matériel here at home, but things are coming along, and troops are going overseas in an excellent state of equipment. Moreover, our matériel is modern and of the highest quality. The quantity is ample; in fact, more than ample. We certainly are overtransported, especially in view of the fact that we must find ships for all our trucks. In any event, the state of matériel is favorable. Would that the picture in all respects were equally so.

As to personnel, your commanders all agree that our Army has superb human material—both officers and enlisted men. You are unsurpassed as potential soldiers, but actually you have not yet reached the peerless class. I do not prophesy that you will be the best, but I believe that you could become the best if you went to work with the fanatical zeal of our enemies.

Such fine soldiers deserve and must have fine leadership. This vital need has been and still is a difficult problem. While our prewar Army had many able and experienced officers—both professional and citizen—the number was far too small for our present Army of millions. However, the situation is being met as our present officers—especially the young ones—gain experience, and by the tremendous output of our officer-candidate schools. These fine young officers, in a sense, are the broad foundation on which our war Army is being built.

Leadership is the first essential of good training, as of battle itself. The leader must teach his troops thoroughly, correctly, and interestingly. It is his duty to see to it that they know the things they must know in order to fight effectively. He must do more—a vital something more. By his personality, enthusiasm, and solid knowledge he must supply the spark which infuses his men with his spirit and carries them individually and collectively along with him.

Many of you no doubt feel that you are something like veterans, for you have been training a long time. On the other hand, some of you are new in the service, even though you may no longer be recruits. On the whole, the Ground Forces are a green army. Whether you are veteran or recruit, training is your object in life. You cannot have too much of it.

THE size of our overseas forces, under present conditions at least, is a matter of shipping. It follows that every man who goes must pay his freight—either directly or indirectly—in combat value. By thorough training, each of you can be worth two untrained men, doubling our total strength overseas. You must train so that our transports will carry record cargoes of fighting power. Training thus far has been good, bad, and indifferent—largely according to the quality of leadership. On the whole, you have trained actively and faithfully. Progress has been praiseworthy. The Army of today is greatly improved as compared with the 1941 model. The older troop units are looking like veterans, and the new units are coming along fast. They soon will be challenging the older ones.

Discipline is definitely better today than a year ago, and this is a sign of the greatest importance. Your spirits are higher, your interest is keener, and your progress correspondingly greater. Perhaps the condition is due to increased pay, and certainly that boon was welcome. Pearl Harbor has spurred. Improved leadership has made itself felt. Whatever may be the causes, the results are altogether encouraging

and helpful in view of the stern outlook that lies ahead.

The maneuvers which have been completed in various parts of the country also have reflected fine progress as compared with 1941. Maneuvers always are a severe test of physical condition and stamina. Those of you who participated displayed a fine brand of soldiering. You put out all the way. You endured real hardships uncomplainingly. Your interest was intense and sustained. You learned a great deal—probably more than you realize. Devotion to duty and heroism during the maneuvers were in evidence constantly—just as truly as in battle, even though less conspicuous. Six officers and one hundred and fifteen enlisted men died from accidental causes attributable directly to the maneuvers. Thirty-three of the deaths were by drowning, many of them due to exploits for which your comrades volunteered in order to further the success of their companies in the mock warfare. Such actions are, if anything, more heroic than in battle, for stimulus and realism necessarily are absent in some degree at maneuvers.

I AM thinking of what is in the hearts of you soldiers, for the spirit is the controlling element in battle. In war men do the impossible. Great souls shine forth—sometimes as officers, sometimes as privates. Perhaps they are born so; perhaps they are made by self-training, by contemplating inwardly what lies ahead, by charting their course and storing up resolve. Great as is the influence of leadership, it alone is not enough. Soldiers—our kind of soldiers—must be right inside. When soldiers are right and leaders lead, the combination is unbeatable, irresistible. Such troops cannot be stopped; they never tire; they never turn back, but go forward always.

Our soldiers must have the fighting spirit. If you call that hating our enemies, then we must hate with every fiber of our being. We must lust for battle; our object in life must be to kill; we must scheme and plan night and day to kill. There need be no pangs of conscience, for our enemies have lighted the way to faster, surer, and crueler killing; they are past masters. We must hurry to catch up with them if we are to survive. Since killing is the object of our efforts, the sooner we get in the killing mood, the better and more skillful we shall be when the real test comes. The struggle is for survival—kill or be killed.

Modern warfare employs many deadly weapons, but men survive in spite of them. The one positive method is hand-to-hand combat. War kills by fire as far as possible, but final victory against a determined enemy is by close combat. For this reason, a fighting army is set to kill, and seeks ever to come to grips with the enemy. I wonder whether you all are thinking in terms of killing by battling man to man. I do not know, and perhaps you do not know your own feelings. A recent group of voluntary enlistments—totaling 30,000—reveals but 5 per cent for the Infantry and Armored Force both. These two arms are preëminently those of close combat. Does this figure mean that our soldiers prefer the more genteel forms of warfare? If so, the sooner we change such preferences, the better for our country. There is no doubt that Americans can and will fight when aroused; they are brave in battle. You are going to get killing mad eventually; why not now, while you have time to learn thoroughly the art of killing? Soldiers learn quickly and well in battle—no doubt about that—but the method is costly to both you and the nation.

Certain surveys have given the answer—true or false—that one-fourth of you want to fight, that one-fourth do not want to fight, and that one-half are on the fence. I'd prefer to think that more than one-fourth want to fight, but even if the figures are true, the picture is all right, because those of you who do not hate now are going to do so later. It is the avowed purpose of the Army to make killers of all of you; if not at home, far from the enemy, then overseas. Also, there are certain indications that one-half of you in combat divisions expect to fight. All of you must not only expect to fight, but must be determined to fight and kill. Again, it is said that one-half of you expect the war to end within two years. But your reason must tell you that it will end only when you finish it. If you intend to do the job in two years, make yourselves into fighting devils now, not later.

If I seem to ask more of you than you have given already, it is not that I do not appreciate what you have done and are doing. You have come a long way and have earned the respect and gratitude of our people. But you still have a rough road to travel. It is too much to expect a peace-loving nation such as ours to turn in a flash and in full fury to an all-out war overseas. Time is necessary for our people and our soldiers to make this transformation. I am not impatient with either you or our people. Nevertheless we must hurry—you soldiers of the nation above all must hurry, for yours is the greatest burden and the gravest responsibility. You have the farthest to go. You must hit harder and harder. You must become tougher and tougher. You must hate more and more. Your devotion to duty must deepen. You must ration your pleasure time. You must think and act war. Casualty lists—and even a defeat perchance—must only fire your zeal the more. You must hurry and you must hate if you will do the job before you.

I KNOW full well that the American soldier is a thinking man, and he thinks straight in the long run. Equally I know that no words of mine can force you to prepare yourself inside for this desperate war. Some things you must think out for yourself in your own way. We salute those who have gone before and shown the way. We take stock of the enemies who threaten us. We review frankly our strength and our weakness—both are formidable. I hope very much that this day will leave you more resolute and purposeful soldiers, ready and eager to go to work harder than ever in this deadly serious task of hitting Hitler and Hirohito on the training ground.

We have applauded and pulled for the Navy, our Air Forces, and our ground comrades overseas, first in the Pacific and now in Africa. You can see the pattern of the struggles which will decide the war. The United States is stretching out its arms to encircle the globe—not in conquest but in protection. Even with our powerful allies, the task is vast and calls for our utmost all-out effort. Let no one of you be the superoptimist and conclude that Africa is the beginning of the end. It is only another great stride forward in our part of the war. Our great advance guard overseas must be followed by a great main body—or else. I hope that it may include you all.

Your country now is the greatest in the world. It has required a century and a half to build. It has given you much, and now it calls for your help—and perhaps you yourself—in return. Your comrades overseas need you now and will need you even more later. The fate of this nation is in your hands; its people trust you, believe in you, pray for you. You must not and will not let them down.

Lend-Lease

The United Nations Pool Resources for Victory in Global War

Maj. Gen. C. M. Wesson*

IT is with considerable hesitation that one discusses the subject of Lend-Lease. This hyphenated word is apt, I believe, to conjure in the mind of the busy man the thought that it is just another way for the United States to give away a lot of things which in the end may beget only international ill will. Moreover, the man absorbed in his work naturally has his paramount interest in those things which touch directly on his day-to-day life—such topics as the cost of living versus income, the local political battle, and what not. Or he may, perhaps, be diverted by events which are sensational in character or which have a romantic tinge. In his mind, Lend-Lease definitely fails to present an appeal from any viewpoint—it just does not register. I thoroughly disagree with both of these attitudes. Lend-Lease has important practical advantages for the United States, and it should be of keen interest to every citizen.

In the first place, Lend-Lease hits the pocket of every one very directly. Every man will have to pay his share in footing the bill which, I scarcely need to say, is no small one. And, secondly, as I shall attempt to point out below, it is contributing very definitely to his present and future security. Furthermore, there is knight-errantry and romance in the delivery—to our own troops and to our hard-pressed allies throughout the world—of guns, ammunition, food, and medicine over submarine-infested seas. This is coupled with the old spirit of accomplishment which, in spite of and perhaps frequently because of difficulties and dangers, has been an American heritage since colonial times.

What could present a greater thrill to the imagination than the delivery of planes over sun-scorched deserts and frozen mountain ranges? Every day and every night, in this great effort, incidents are occurring which should stir men's souls. The Greeks at Thermopylæ, Arnold von Winkelried at Sempach, and the charge of the Light Brigade at Balaklava are having their modern counterparts almost daily in Great Britain, in Russia, in Africa, in the South Seas—everywhere the allied forces are meeting the hordes of the Axis.

When the present world conflict began in September 1939, most of us in America hoped, and many of us believed, that we could keep out of it. Even after the smashing defeat of Poland, we rested our hopes on the Maginot Line and we could see no serious threat to our country. But when Denmark, Norway, Holland, Belgium, and finally France were overrun with bewildering speed and the Nazis were poised for action on the Atlantic seaboard of Europe, we could no longer feel secure. In fact, it seemed to many that we might be facing a victorious Germany unarmed and alone. The Battle of Britain happily proved that this view was wrong. The R.A.F., small but splendidly equipped and incredibly valiant, outfought and outgained the mighty *Luftwaffe*. Britain was saved. As Mr. Churchill so aptly said, "Never in the field of human conflict was so much owed by so many to so few."

And then it began to dawn on us that perhaps *we* were among the many who owed so much to those few. This realization had its first expression in the "destroyers-for-bases" deal and later in making available, under the Exchange Contract Law, rifles, cannon, and ammunition to England after her Army had been denuded of equipment at Dunkerque. This realization grew in strength and came to full fruition in the Act of March 11, 1941, known as the Lend-Lease Act. This act, in effect, was an announcement to the nations of the world that the United States recognized that the defeat of Germany, Italy, and Japan was essential to its own security. It expressed the calculated resolve of the United States to furnish all possible material aid and services to the nations fighting or threatened by the Axis, and to allow no obstacle to stand in its way. It was the only means for doing legally those things which had to be done in the interest of our future safety.

This act authorizes, not loans of money, but loans of goods and services. By goods is meant not only military items, but all other materials essential to the war effort such as metals, foodstuffs, and medicines. By services is meant chiefly repairs to damaged ships, dollar transportation costs incurred in getting weapons to the fronts, and improvements and additions to both base and transport facilities.

THERE is a limit to the capacity of our Arsenal of Democracy, vast as it is. Its output must be carefully allocated. Money loans, permitting each ally to be its own purchasing agent, would result in unrestrained competition between the allies for our products, and that would be intolerable. For this reason we have elected to furnish them with goods and services which our Government first procures itself. The goods and services, as procured, are divided among our allies and ourselves by expert interallied boards. But whoever the ultimate consumer may be, there is always a single procurement agency—the United States Government.

We are not the only ones supplying goods and services. In their own countries, our allies are supplying weapons, food, and accommodations to our troops abroad which are vital to their training and operation. For example, in preparing for our recent movement into North Africa, a very considerable part of our equipment was furnished in Great Britain from British stocks. I wish to emphasize that these issues were not made from surplus stocks, because there was no surplus, but from stocks actually held for issue to British troops.

The Lend-Lease Act was passed none too soon, for while aid began at once to flow in small quantities, it takes time to convert appropriations into concrete things, and it was not until considerably later that the first trickle began to take on the size of a respectable stream. We are only too prone to believe that when money has been provided for material things, these will at once appear. The time factor, so essential to preparation for war, has never been recognized by our people as a whole. Modern warfare is a complex business and requires long periods of preparation before the plans come to fruition. The situation in the Middle East

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and in Africa emphasizes the months of long preparation required to do a proper job and the benefits secured by waiting until preparation is reasonably complete before initiating "all-out" action.

Of the total aid rendered before Pearl Harbor, less than one-third was in the form of military armament, the majority being foods, raw materials, machine tools, etc. And the armament percentage would have been even less but for the fact that the act authorized the diversion of our own armaments up to the value of $1,300,000,000 which had been provided for in military and naval appropriations made nearly a year before. You can't buy armament off the shelf!

IN this effort to aid others, many, I dare say, little appreciate how much in reality we were helping ourselves. On the passage of the first Lend-Lease appropriation under the act, large sums were at once put to work to create additional production and distribution facilities. At that time, nine months before we were viciously attacked by Japan, we as a people could not, of course, visualize the tremendous increase in production demands which followed the events of December 7, 1941. But the facilities created to meet Lend-Lease demands have proved to be of inestimable value in our own war effort, particularly in the saving of priceless time—which means, in the end, the saving of priceless American lives.

Who will dare to say what would have happened if England, in December 1940, fighting alone, her factories under a hail of bombs and her dollar balances approaching the vanishing point, could no longer have looked to the United States for cannon, powder, machine guns, ships, food, medicine, and other assistance of a vital nature?

Lend-Lease was launched with a fervent prayer that by throwing our material resources into the fray, we would ourselves be spared the horrors of war. Pearl Harbor dispelled that illusion. The tragic events of December 7th naturally produced many changes in the nature of the Lend-Lease program. No longer were we detached and aloof from physical combat in the tremendous world-wide struggle. We had to give greater heed to the needs of our own armed forces, whose requirements tripled overnight. We had to train and equip a huge army, air force, and navy, and do it with a minimum of delay. We had to build, in greatly increased numbers, the ships and planes necessary to transport these forces to the fighting fronts and to supply them when they reached their destinations. At the same time, however, we could not ignore the pressing demands of our allies who were doing the bulk of the actual fighting.

One fact stands out above all others—the war being waged all over the world should be considered as one war. It must be fought as one war, not as a series of separate wars—not one between the United States and Japan, another between England and Italy, another between Brazil and Germany, etc. This single war requires a single strategy in accord with which all the resources of all the United Nations should be put to the most effective use. This results in sending American tanks to Russia, British pilots flying American Kittyhawks over the Libyan Desert, American pilots flying British Spitfires over occupied France. It means feeding American troops in Australia with Australian-grown food and sending agricultural machinery to Australia to help grow this food. It means British antiaircraft devices guarding some of our defenses and American troops guarding the shores of the Fiji Islands.

From these very few examples can be seen the comprehensive development of the Lend-Lease idea. It can be seen that Lend-Lease is not a one-way proposition. On the contrary, it is a factor of tremendous weight in the fight which the United Nations will wage until victory is complete. It is designed so that each nation will bear its proportionate share of the task of supplying necessary goods and services and will make them available to those in position to use them to the best advantage.

The development of the pooling-of-resources idea has been reflected in recent appropriations made by Congress for Lend-Lease activities. The first appropriations were made directly to the President and were then apportioned to the War Department, Treasury Department, Navy Department, Agriculture Department, and Maritime Commission for programs for particular items for particular countries. Now the appropriations for Lend-Lease military, naval, and maritime items are lumped in the regular appropriations of the Army, Navy, and Maritime Commission, respectively. This makes for greater simplicity in procurement and greater flexibility in the assignment of finished material. The Munitions Assignments Board is the agency which has been set up to assign all military and naval items.

We still have, however, separate appropriations for non-military supplies, such as food, medicines, raw materials, industrial equipment, etc. Under these appropriations, funds are allocated to various procurement agencies to buy items for specified countries. Except for items of a special nature which must be procured as needed, items which are in demand by more than one country, such as food, tanks, trucks, guns, etc., the needs for which can be clearly foreseen, are purchased in quantity and placed in depot stocks to be immediately available whenever and wherever needed to meet the exigencies of the strategical situation.

IT seems pertinent to recount in dollars the extent of Lend-Lease aid. Dollars are necessarily used as the yardstick for the lack of any other common denominator applicable to so diverse a program. During the nine Lend-Lease months of 1941, $910,000,000 worth of goods were transferred and $334,000,000 worth of services were rendered. For the first nine months of 1942, four times as much aid in these forms was given. Moreover, the proportion of military to non-military items has greatly increased. For 1941 it was less than one-third, but in September 1942 about seventy-five per cent of the goods transferred were military items.

The President, on November 15, 1942, released some startling figures on Lend-Lease aid for October. More than $915,000,000 worth of goods and services had been furnished to our allies during the month. This topped the record of any previous month by more than a third. From July to November 1942, when we had the imposing task of arming, equipping, and transporting our strong expeditionary force now in North Africa, we were able to transfer $2,713,000,000 worth of goods and services to our allies. Two-thirds of the goods were military items, including large numbers of planes and tanks that helped to turn the tide in Egypt and to hold the lines in Russia.

In September and October 1942—when our preparations for the African campaign were at their height—more than $918,000,000 worth of military items were transferred to our allies. This is to be contrasted with the $169,000,000 worth of military items transferred at the outset of the war in the months of December 1941 and January 1942.

The basis of Lend-Lease appropriations is requirements, as well as these can be forecast. And these in turn are governed by the over-all strategic plans in relation to the availability of raw materials and production facilities. Because of the relative accessibility to each other of the United States and the British Commonwealth of Nations, and because the United States and the United Kingdom have the production capacity which must supply the greater part of Lend-Lease aid throughout the world, these two nations have pooled their supplies and facilities with the objective of their best utilization for the effort of all concerned.

I shall not attempt to go into the ramifications of the complex organization designed to accomplish these ends. The problems involved are exceedingly intricate and difficult of solution. There is a constant necessity for give and take. The war is changing from day to day, and the machinery for furthering it must be flexible enough to respond promptly to its ever-changing demands. The Combined Production and Resources Board was set up by the United States and the United Kingdom for the purpose of coördinating the production facilities and the available raw materials of these nations for the most effective employment in the war effort. The Combined Raw Materials Board, under direction of the Combined Production and Resources Board, determines the available supply of critical raw materials and recommends their assignment. Raw materials allocated to the United States must in turn be reallocated through the machinery of the War Production Board to the Army, Navy, Maritime Commission, Lend-Lease nonmilitary supply, and the home-front program.

Lend-Lease provides for the nonmilitary items which are required by the forty-three countries designated by the President for Lend-Lease aid. A Combined Shipping Adjustment Board is responsible for coördinating the assignment of shipping. The Combined Food Board determines, in collaboration with the War Production Board, the Food Requirements Committee, and the British Ministry of Food, problems which arise in connection with food distribution.

THE foregoing account is a gross oversimplification of what is in reality an exceedingly complex series of procedures. I have only sought to give in a few words some idea of the machinery for solving the problems in the international field. To go into the items of actual purchase would take the discussion into detail which would obscure the general picture. The Lend-Lease Administration is an allocating and not a procuring agency. The War and Navy Departments and Maritime Commission do the actual work of procuring military, naval, and maritime supplies. The disposition of the appropriations for nonmilitary supplies made directly to the President is supervised by the Office of Lend-Lease Administration, which, on approval of requests from Lend-Lease countries for general nonmilitary supplies and services, forwards these requests to the proper procuring agency, such as the Treasury Department and Agriculture Department, which thereupon performs the actual purchasing.

The Lend-Lease Administrator is E. R. Stettinius, Jr., a great public servant whose distinguished career is well known. One of his prime responsibilities is to work with the foreign governments in the development of their requirement programs for nonmilitary supplies and services and to coöperate with them and with the other agencies of our Government in formulating broad programs for Lend-Lease aid. The administrator must approve or disapprove requests of Lend-Lease nations for articles or services, deciding whether a given article or service is properly lend-leasable and whether it could be obtained more advantageously in some other fashion. A prime requisite in establishing the lend-leasability of an article is that it must accelerate the war effort. The approval of requisitions by the administrator is in no sense final if in competition with our own requirements. In such cases, they have to be cleared through the War Production Board before they can be routed to the various procuring agencies to undertake purchase.

The Office of Lend-Lease Administration has a dual responsibility: It is a friendly and sympathetic sponsor for the various Lend-Lease countries; yet it must assure itself of a real justification for the goods and services requested by them. In certain countries we have missions which do the preliminary screening of requests which are being initiated by these countries. These missions work under the supervision of the State Department representatives in these countries. They supply us with information most helpful in arriving at sound decisions. In other cases, the office must proceed without the help of such missions.

The Office of Lend-Lease Administration is a part of the Office for Emergency Management. It is the agency set up by the President to keep the records of Lend-Lease transactions and report to him the status of the Lend-Lease program as a whole. This includes all projects under Lend-Lease, whether undertaken by the Army, Navy, Maritime Commission, the Treasury or Agriculture Departments. The Lend-Lease policy initiated by this Government will stand, in my judgment, as the greatest single step forward ever made in promoting international good will. What effect it will have on the postwar world no one can forecast. The basic philosophy of Lend-Lease may be, and let us hope it will prove to be, the foundation for great coöperation among the nations of the world and an everlasting factor in the maintenance of peace.

One thing is certain today. We are getting big dividends from the Lend-Lease program. On November 9th a release from the White House quoted the President to the effect that the magnificent British victory in Egypt was aided to an important extent by the Lend-Lease Act and is an outstanding example of the combined use of American and allied resources. The President further said: "While we must not overlook the fact that the larger part of the equipment used in Egypt is of British origin, we have a right to be proud that so much and such excellent equipment from American factories and shipyards contributed to the victory. In particular, we should be gratified by the performance of American-made tanks. In the Egyptian campaign we can see the vindication of the Lend-Lease idea. We propose to continue to expand our Lend-Lease aid to all of our allies until complete victory is achieved."

EDITOR'S NOTE.—Mr. Stettinius, the Lend-Lease administrator, in a recent statement stressed the fact that Lend-Lease has never been a one-way affair. "In addition to the other benefits which the United States receives in return for Lend-Lease aid," he said, "our allies are providing us with supplies and services as reciprocal Lend-Lease. These are provided without dollar payment on our part. Reciprocal Lend-Lease has already saved millions of tons of shipping space and hundreds of millions of dollars. . . . Among the most important reciprocal aids we have received from the United Kingdom is the full benefit of British scientific research."

Mission to China

An Account of United States Military Aid to a Fighting Ally

Col. E. E. MacMorland*

IN July 1941, when Lend-Lease aid to China was beginning to crystallize in the form of requirements for military and other supplies, it became apparent that the United States should send a military delegation to study the minimum needs for prosecuting the war and to instruct the Chinese in the use and maintenance of the matériel furnished. Most urgent was some effective assistance both in supply of motor transportation and in its maintenance and operation to increase the traffic over the Burma Road, China's life line to the outside world. Generalissimo Chiang Kai-shek took the initiative by asking President Roosevelt to select and dispatch a military mission. The President approved the request and directed the Secretary of War to form the U. S. Military Mission to China.

Mr. Stimson selected to head the mission Brig. Gen. John Magruder, an officer with a background of eight years' experience as military attaché in China and a penetrating student of Far Eastern affairs. General Magruder immediately gathered a staff of specialists, arranged for the dispatch of motor transport and other supplies for Mission use, set up a home office in the War Department to insure that requests sent back by the Mission were not overlooked or ignored in the increasing welter of war preparations, and, on September 18, 1941, departed for the Orient by airplane, accompanied by Major General Kiang, of the Chinese Ordnance Corps, and two of the Mission staff. The remainder of the staff followed by airplane and surface vessel, and it was not until December 21st that the last echelon bringing the motor transportation from Rangoon over the Burma Road arrived in Chungking.

I was in General Magruder's party as his chief of staff. We stayed a few days in San Francisco and then began the long journey by Clipper to Manila. Honolulu, not such a gay place as on my previous visits, still qualified as the paradise of the Pacific; Midway and Wake were in a fever of defense preparations; Guam was practically defenseless. Several other members of the Mission had joined us en route and our party numbered seven as we settled down for a short stay at the Manila Hotel.

There was an air of tenseness about Manila. The women and children had gone home. There was little social life, and the Army and Navy Club was like a tomb. The Filipino Army and our own troops were undergoing intensive training. General MacArthur's headquarters in the Cuartel de España were a beehive of activity. It was evident that nothing was being left undone to insure a stout defense of the Philippines with the means available.

As we had been directed to coördinate our activities with those of General MacArthur, we held several conferences with him in which he developed his views on the China situation. I recall that he particularly dwelt on the importance of Chinese guerrilla action behind the sprawling and irregular front in China and of the desirability of limited local offensives until the Chinese could be supplied with Lend-Lease equipment. Sir Robert Brooke-Popham, commanding in Malaya, visited Manila during our stay, and from him we learned something of the British plans for the defense of Singapore. He, too, was interested in the potentialities of China if a crisis should develop in the Far East.

Characteristic Chinese hospitality met us first at Honolulu, where the Chinese community entertained lavishly for the Mission. At Manila it was much the same, and we had to school our stomachs to the 14-course meals which make up official entertaining. I have always dreaded a Chinese banquet, but a Chinese "home" meal of rice and four dishes is not excelled anywhere in the world.

Our days in Manila were few. Shortly after sunrise on October 5th we took off from Cavite in three Navy PBY flying boats, made available by Admiral Hart, and laid our course for Hong Kong. Six hours later we circled the harbor at Hong Kong and glided down over the hills for a landing. The arrival of our PBY's caused quite a stir. Some wondered whether these sturdy long-range scouting planes were to be added to the defenses of Hong Kong, woefully deficient in air power, and there was keen disappointment when it was learned that they were to return immediately to Manila. I have often wondered what happened to the PBY which carried me to Hong Kong; it belonged to the squadron which was to take such a gallant part in the defense of Manila and arrive in Australia with only three worn-out planes left.

DR. HOLLINGTON TONG was at the landing stage to welcome the Mission in the name of the Generalissimo. We were soon established in the Peninsula Hotel in Kowloon, and the official round of entertainment began. The Chinese community seemed glad that we had come and overwhelmed us with official welcomes and dinners, a portent of what we were to experience in Chungking. Perhaps the most unforgettable character I have ever met was my host at the Golden Dragon Restaurant one evening. This was Sir Shou San Chow, K.C.M.G., a merry oldster of 81 who had graduated from Columbia University in 1880. Sir Shou San was a curious mixture of Chinese and Western culture, one of several Chinese holding British titles for services to the Crown Colony.

The high point of our stay was a visit to the defenses with General Maltby, the garrison commander, now a prisoner in the hands of the Japs. Little could I suspect, as I examined one of the modern 9.2-inch guns, how very soon that very gun would be silenced by air bombardment. The defensive positions both on the Kowloon side and on the island seemed strong enough for a prolonged resistance, but the garrison was pitifully small to hope for success against the two experienced divisions which the enemy found it necessary to throw against the city in December. The greatest weakness, however, was the lack of aircraft. General Maltby realized that he was likely to be in a hot spot if he had to fight, but, like the good soldier he is, he seemed determined to defend Hong Kong to the limit of his resources.

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Hong Kong was crowded with refugees from the Chinese hinterland—poor, hunted-looking people who used the sidewalks for homes and were fed by the authorities. There was some concern that the stored food stocks would not be sufficient to fill all those extra mouths. It was probably just as well, if the city was destined to fall anyway, that the end should come quickly to avoid the horrors of starvation incident to a long siege in a restricted area. Air-raid shelters were numerous but not adequate for the population.

Superficially, Hong Kong seemed to be a much safer place than Chungking was likely to be. It was pleasant there for those who had money to pay, enjoying with Shanghai the distinction of being the last comfortable places for foreigners in China. That all of this could change so completely in a few days in December was inconceivable to me as I prepared for the last leg of the long trip from Washington.

Our impatience to move on to Chungking was finally satisfied on the morning of October 9th. With some secrecy we were warned to be at KaiTai Airport at nightfall. We were to go to Chungking in a chartered DC-3 airplane of the China National Aviation Corporation, a 5-hour flight part of the way over Jap-controlled areas.

SOON after dark the DC-3 lumbered down the field and took off. Within five minutes we were back on the ground because of engine trouble. Another plane was rolled out, and after an hour's delay we were again in the air winging our way north to give a wide berth to the Canton area where the enemy had plenty of fighter planes. Looking out from our darkened plane, I had a very helpless feeling as I saw nothing but solid cloud banks beneath. I hoped that the pilot was a good navigator. We were flying certainly under the worst conditions. Just as I was about to decide that I was nervous, the door opened and the pilot himself came into the cabin. He was Leonard, a keen-looking young American whose flying exploits in China were a part of the saga of China National Aviation Corporation, the most interesting airline in the world. Leonard sat down next to me, and we were soon discussing aircraft. The door to the cockpit shook open while we were arguing the merits of various American fighter planes, and I saw that there was nobody at the controls. The Chinese copilot was in the corridor engaged in some task.

"Do you know that the ship is flying itself?" I asked.

"Yes, the automatic pilot is on," Leonard said with a careless glance up front. "We are on the course for Chungking now. I changed the course just before I came out here. Flew eighty miles due north from Hong Kong to pass over the Japs at a thin place. We're now well out of their area and ought to reach Chungking about one o'clock."

"You surely have a lot of confidence in that iron mike."

"Yep, that and the Telefunken to let me down when we get there," Leonard said. "Don't get me wrong. This night flying business is no picnic under the weather conditions you see outside, but we have had to do it since the Japs shot down two of our transports when we were flying in the daytime. They can't find us in the dark and have long since given up trying. We will be at Chungking at one o'clock, as I told you before. I can't go into the river airport, however. The water is still over it, so we will land at a military airport about forty kilometers from the city. Guess I had better get back. Time to get my Telefunken tuned in."

"What's the Telefunken?" I wanted to know.

"That's a Heinie radio homing device which makes it possible for me to fly in this weather. We have them on all our ships." He went forward to the cockpit.

I settled back in my seat convinced that here was a fellow who knew his business. He soon proved it. At one o'clock we nosed down through the clouds and there was the landing field, dimly outlined by oil lanterns. Leonard circled the field and then came in for a perfect landing using only the lights on the plane. To me, it was a remarkable performance; to the C.N.A.C. pilots, it is a commonplace.

ALL official Chungking seemed to be waiting to greet us. They had been there a long time, for we had had to go back to change planes. General Sun, later to become famous in Burma as the commander of the 38th Division which rescued the Burmese Division at Yennaungyang, became my escort, and we were soon bumping over a typically rough Chinese road toward Chungking. We talked about America, and Virginia in particular. Sun is a graduate of Virginia Military Institute and had already established a reputation for himself in the Shanghai campaign—a young man, a fighter, and a credit to his alma mater.

The lights of Chungking finally came in sight. I was surprised to see electric lights in this much-bombed city and more surprised that there was no black-out. But a greater surprise was in store—the house assigned to us for our headquarters and living quarters was a fine brick building set in a pleasant garden, equipped with good furniture, lights, running water, and a fine staff of servants. This house had been bombed, but the Generalissimo a month before our arrival had ordered that it be made ready for us. His order had been so well carried out that it was difficult to see where the bombs had originally damaged it.

The next day was October 10th, "Double Tenth" in the Chinese calendar—the tenth day of the tenth month. It happens that the "Double Tenth" is also the anniversary of the birth of the Republic. To the celebration of the birth of the Republic had been added the good news of a rap the Chinese Army had given the enemy at Ichang. There was, therefore, an air of general rejoicing at the outdoor celebration which we joined at the recreation center. An international flavor was given the athletic events by a softball game between the sailors of our gunboat TUTUILA, the U. S. station ship at Chungking, and a Chinese team.

We were then engulfed in a round of receptions and dinners. As the symbols of American help, we were overwhelmed with entertainment and we wondered when we would be able to get any work done. We did manage to meet our "opposite numbers" in the Chinese Army and to lay the basis for future collaboration. Our mentor and friend at this time and thereafter was Gen. Shang Chen, chief of the Foreign Affairs Bureau of the National Military Council, who had been detailed by the Generalissimo to look after the foreign military missions. Gen. Shang Chen speaks English and was already known to some of our officers who had served in Peking. Without his help we could have accomplished nothing. He enjoyed the confidence of the Generalissimo and arranged our contacts with both the Generalissimo and other ranking officials in the government.

The Generalissimo was absent when we arrived. The War Minister, Gen. Ho Ying-Chin, promptly received us and pledged his aid to our activities. We had many matters to take up with General Ho and were always well supported by him. The other high Chinese officials after that unfailingly tried to find ways to carry out proposals made by us.

I always felt that we had much to learn from the Chinese. After all, they had been holding out against a powerful foe for five years and were at that time keeping about thirty Jap divisions occupied against their poorly equipped troops.

IT WAS soon apparent that our job was to see what could be done to offset the superiority in equipment which the Japs had enjoyed so long. Getting material help into China over the long route from Rangoon and then teaching the Chinese how to use American equipment were the main features of the problem we faced. This problem divided itself into several more or less well defined parts:

1. The Burma Road had to be improved, to permit a larger volume of traffic, by a surfacing program, better telecommunications, a traffic-control system, and a vehicle-maintenance set-up.

2. Trucks had to be provided from the United States, together with the means to maintain them.

3. As the Burma Road (then delivering only 12,000 tons a month) was estimated to be capable of rapid development to only about 30,000 tons a month, a railroad from Lashio (Burma) to Kunming (Yunnan Province) was deemed necessary to carry at least 600 tons a day, the amount then being brought by the Burma Railways from Rangoon to Lashio.

4. Schools to teach the Chinese Army to use the armament being furnished had to be established.

5. The needs of the Chinese arsenals for raw materials had to be estimated and obtained on Lend-Lease.

6. The minimum needs of the Chinese Ground Army for matériel to enable at least a selected part of it to undertake offensive operations had to be determined.

7. The improvement of the Chinese Air Force, then hopelessly outclassed by the Japs, was vitally necessary.

This was an ambitious program on which considerable progress had been made when the Japs began their invasion of Burma in January 1942. The Burma Road had been asphalted as far as the Salween River; traffic volume was steadily increasing; many trucks had arrived from the United States for assembly in a Lend-Lease plant in Rangoon; the railroad had ninety per cent of its earthwork, tunnels, bridge piers, and other right-of-way features completed and would have been in operation in December 1942, with rails, rolling stock, and locomotives from the United States; some American armament and arsenal materials had arrived in Kunming and, in fact, a number of American 75-mm. field howitzers were used by the Chinese in the Burma campaign. Little was done for the Chinese Air Force during this period because of the lack of available planes, but it should be remarked that the American Volunteer Group was a unit of of the Chinese Air Force, flying American P-40's purchased by the Chinese themselves prior to Lend-Lease.

After the subsidence of our official reception, I had a chance to look at Chungking. The city had been bombed nearly 200 times and much of it was in ruins. The south bank area, where the foreign embassies are located, had been completely spared. The clearing of the debris had brought with it the widening of the main streets and much dust and mud. The indefatigable Chinese had made good progress in erecting temporary structures and repairing bombed buildings. The city is located high above the Yangtze, reached by many steps from the river. You must get accustomed to steps in Chungking, unless you desire to hire a chair (with three coolies) or a stair-climbing pony.

The air-raid shelters are the best in the world—long galleries carved out of the hillsides. These shelters are adequate for the normal population, but one of the vexing problems of the mayor has been to get the floating population out of the city for the "bombing season," which used to be from April until about November when the valley becomes overcast for almost the entire winter. Air-raid shelters would of course be of little use if it were not for the air warning system. The city gets a warning at least forty minutes and sometimes even longer before the approach of the enemy by a system of telephone and radio warning stations. During my entire stay in Chungking there was no bombing at all, nor has there been any bombing since my departure. Our concern was not so much for our lives, if the enemy bombed, as for the possible loss of our clothing in the house. The shelter was only a few hundred feet away, but our clothing would be irreplaceable if the house were hit.

THE city was much overcrowded with refugees from the east, yet there seemed to be no starvation. I saw only a few beggars during my entire stay in Chungking. Very little merchandise was in the shops when we arrived, soon after the end of the "bombing season," but before the end of the winter it was astonishing how much merchandise had returned from its hiding places in the country. It is remarkable how little can constitute the stock in trade of a sidewalk merchant. Three small heaps of peanuts made up the stock of one old Chinese woman I noticed one day.

The people were a constant source of wonder to me. The coolie class is truly indestructible. The hardships they withstand uncomplainingly give them a certain nobility of character. Their ability to work almost at the starvation level is remarkable. Nowhere in the world are the common people so hospitable and kindly. From this coolie class come the Chinese soldiers, unequaled in their ability to slap along in their straw sandals thirty miles a day, heavily laden, fed with only a handful of rice. Often I have stopped to watch in admiration the passing of a Chinese column—fatigue-drawn faces but no stragglers, heads a bit higher because the foreign officer is watching, everything on the backs of men or the ends of carrying-sticks and no baggage train—getting over the ground much as Stonewall Jackson's "foot cavalry" moved in the Civil War.

The Generalissimo returned to Chungking late in October and immediately called General Magruder to a conference. I accompanied our chief, and while he did the talking I studied Chiang Kai-shek. He is a man of mild and unaffected manners, possessed of a keen mind, and blessed with the great ability to strip any matter under discussion to its essentials and make a forceful analysis. He usually makes his decisions promptly and follows them up with clear orders. The Generalissimo speaks no English and consequently has to use an interpreter. Fortunately he has Dr. Hollington Tong (University of Missouri, 1912) to translate from Chinese into idiomatic English—no easy task. I came away from this initial 2-hour conference convinced that I had met one of the world's great men. That fine personality, Madame Chiang, was also present to greet us. Of course she speaks English fluently and is present at practically all state conferences with foreigners. She has vivacity and charm, and a masculine ability to handle the administrative burdens of several large enterprises, including the care of war orphans, which she heads.

During the months that followed, we saw much of the

British Newsreel

CHINESE TROOPS PASS THROUGH A BURMESE VILLAGE EN ROUTE TO ENGAGE THE JAPANESE

Generalissimo and Madame Chiang. Once they accepted an invitation to dinner at our house—a great surprise because the Generalissimo rarely goes out to dinner. Always there was the utmost cordiality to Americans. What was discussed in the conferences of this critical period when the United States was on the verge of war, I am, of course, not permitted to disclose, but there is certainly no harm in stating that the Generalissimo always took a soldier's viewpoint and showed fine strategic insight concerning the war problems of the Far East.

The Chinese have a well-developed system of arsenals for the production of military equipment and an ordnance organization founded on sound traditions. At the head of the Chinese Ordnance Corps is Gen. Yu Ta-Wei, who obtained his practical experience in the German arsenals. He is supported by a capable corps of managers, most of whom have had German industrial experience. For military reasons, little can be published about the quantity of the output of the arsenals or about their locations, but it may be said that they can produce most of the essentials for combat if given outside assistance in the supply of certain raw materials.

Soon after our arrival in Chungking, Lieut. Col. Walter H. Soderholm and I visited an arsenal which produces small-arms cartridges. The manager was one of General Yu's German-trained men, and his cartridge-making machinery was of German manufacture. By our standards the machines would be considered obsolete, but they were nevertheless turning out cartridges at a good rate. The workers were old men, women, and children gathered from the nearby countryside. Since we were a bit skeptical as to quality, tests were fired for us in a rifle and machine gun. I could find no defects in the fired cases, and the accuracy compared favorably with that of American ammunition.

As with this arsenal, so it was with others visited by our people. All were working under difficulties, but military material was nevertheless being produced with the means available. I always looked favorably on the raw-material needs of the arsenals, feeling that the supply of raw materials on Lend-Lease was a very effective way to help the Chinese gain industrial experience while producing their own munitions.

ASIDE from occasional warnings from the Chinese intelligence service that the Japs were becoming active in Indo-China and might attempt a drive into China toward Kunming, that large convoys had been spotted in Indo-China waters, and that withdrawals of troops from China seemed imminent, the end of November came without any hint of the extensive Jap attack soon to take place. The enemy had been able to conceal his treacherous plans even from the alert Chinese intelligence personnel.

As China is on the other side of the date line, Sunday, December 7, 1941, was the day before Pearl Harbor. It was a pleasant day, and I went for a long walk, looking into the shops and at the thriving trade on the sidewalks. Usually we worked all day on Sundays, but for some reason this Sunday was particularly quiet. Even our usual volume of messages from Washington was much less. I went to bed that night expecting a sound night's sleep after an easy day. The telephone began to jangle before daylight. I lay there cursing our coolie for not getting up to answer, fully expecting soon to hear his gentle scratch on my door to tell me that someone had arrived from Hong Kong on the night plane and would I please go to the airport to meet him. This time, however, General Magruder went to the phone himself. He was soon in my room.

"Mac, we are at war with Japan!" he said excitedly. The Japs had attacked Pearl Harbor and apparently a good many of our ships had been sunk. The Philippines and Malaya had also been attacked. Hong Kong was being bombed. They had apparently struck everywhere at once.

Then followed a hectic day. We were besieged by reporters. Chinese officials called to exchange views. Our British colleagues came to confer. At 9 P. M. the Generalissimo presided over a conference of allied officials, following it with an announcement that China would give whole-hearted support to the United States and Britain. Ways and means were considered to succor Hong Kong, and the Generalissimo ordered up certain assisting concentrations, which were, however, never completed because of the quick fall of the city.

We had also learned that the Japs were on the move in China. The Jap commander at Yochow was reported moving with 80,000 men toward Changsha on the Canton-Hankow Railroad, an important point astride the railroad which had long been held by the Chinese. To the credit of the Chinese, this drive on Changsha ended as the first victory of the United Nations when the Japs got bogged down in the mud, without air support, and were finally forced to beat a disorderly retreat back to Yochow.

AS THE Far East crumbled under the enemy onslaught, the Mission increased its efforts to help the Chinese move supplies from Burma into China. The Rangoon group of the Mission was augmented, and as the Japs advanced down the Malay Peninsula toward Singapore, it became only too evident that Burma was next on the conquest schedule. Late in January 1942, the invasion of Burma was in full swing, and the Mission's plan to evacuate the supplies from Rangoon was put into effect by the Chinese. Briefly, this plan was (1) to assemble as many of the boxed vehicles then at Rangoon as possible and use them to move supplies; (2) to bring down from China both drivers and additional vehicles; (3) to move as much as possible on the Irrawaddy River and the Burma Railways; (4) to use Yamethin (300 miles) as the first staging point for the motor convoys, with later staging to Lashio.

With the help of the Chinese, British, and a group of forty-five American motor-transport men who had just arrived for service on the Burma Road after a thrilling voyage from the United States, the Mission was able, before February 20th, the last date for remaining safely in Rangoon, to evacuate practically all supplies of value, except a quantity of motor vehicles which could not be assembled in time and had to be burned. After the loss of Rangoon, the American help in moving supplies out of danger continued until most of the stocks were either across the border in China or in the Lashio area of northeast Burma. While supervising one of the convoy movements in Mandalay, during the latter part of the Burma campaign, one of the original Mission officers, Maj. James Wilson, was killed in a bombing raid. After all the effort to get these essential supplies moved through Burma, it was our misfortune to see the bulk of them lost when the Japs made their rapid advance up the Burma Road to the Salween River at the close of the campaign.

At the end of January, with the situation critical in Burma, General Magruder had decided that I should go to Rangoon to ascertain how our personnel were getting along with the evacuation plan. The city had been heavily bombed, particularly near the end of December 1941, and many of the people had departed, so that labor to carry on was becoming a problem.

The China National Aviation Corporation had ceased flights into Rangoon and was making only one stop in Burma, at Lashio. When I arrived at Lashio, I was faced with a tiresome 2-day journey on a train. Luck favored me, however, and I went by plane instead. Air Vice-Marshal Stevenson, who had just arrived from China in a Blenheim, offered me a lift to Rangoon in another Blenheim then at the airdrome.

The trip to Rangoon had some exciting moments. The enemy had been bombing Toungoo that day, so the pilot flew in a wide circle, skimming the trees to approach Rangoon from the west. After three hours with still no signs of the airdrome, the gas supply ran low, and it looked as if parachutes would soon be needed. The pilot had not fueled his plane at Lashio. Finally we spotted the airdrome, and I was much relieved when we rolled down the field. Ten minutes' gas supply was left in the tanks. There had been some enemy fighter raids that day, so our ship was promptly removed from the field, while I went over to the American Volunteer Group operations office to get acquainted.

There were then two squadrons of this remarkable organization at Rangoon. They had made it so hot for the Japs since the big raid on Christmas Day that the enemy had given up day bombings. But the Jap pursuit planes kept up day operations and consequently one or the other of the two squadrons was in the air more or less constantly during daylight hours. The boys showed the strain but were getting a great kick out of their many successful air combats with the enemy. Their P-40 planes were, however, not particularly suitable for night operations, nor were the men trained for such work. There was nothing to do but to disperse each evening and let the enemy come over and bomb at night if he so desired.

DURING the week I was in Rangoon, the Japs came over every night in the light of a full moon—in one night no less than six times. They did not get away entirely unscathed. The British put up two Hurricane night fighters which accounted for five bombers during two of the raids. The bombing efforts were concentrated rather ineffectively on the airfield, seven miles from the city, and the densely populated area escaped damage during this period.

Most of the civilian population had left the city. The dock area was a beehive of activity getting ships unloaded and military cargo moved northward. The General Motors assembly plant for motor vehicles was battling with the problem of a huge storage yard filled with Lend-Lease boxed vehicles which would require at least another month to assemble even if the workmen could be kept on the job, and that was an impossible hope with natives who took to their heels every time the air-raid siren sounded and stayed away for hours or never returned at all. Several hundred Chinese, sent in by the Chinese Government and supervised by some of our American Burma Road employees, assembled all the jeeps and scout cars in the port and managed to get them driven north to Lashio. These Chinese were soldiers who stayed on the job during air-raid alarms. Business was of course at a standstill and most of the shops had been evacuated. The roads were filled with refugees on their way to India. Food was becoming scarce, the Japs were already at Moulmein, and it seemed probable that the city would be isolated in a few weeks when the enemy offensive reached

Pegu. Chinese troops had arrived in Burma, but it was unlikely that they would advance south of Toungoo. The British were slowly retiring before superior forces in the Moulmein area.

With this gloomy picture in mind, and after seeing the evacuation of Chinese supplies initiated, I started for Lashio in one of the Chinese jeeps. It was a 2-day trip through pagoda land, a peaceful countryside soon to blaze with war. Aside from the many pagodas, perhaps my most striking remembrance is that of the yellow-robed priests. They were everywhere in large numbers. The reason became apparent later—many of them were the fifth columnists who caused some trouble in the final phases of the Burma campaign. From the tropical climate of Burma, I was soon back in the chilly overcast of the Chungking winter. Six hours' flying in that part of the world covers some great changes in climatic conditions.

Soon after my return, we celebrated the festival of Chinese New Year, which falls on February 15th. This is the time for the annual settlement of accounts and is accompanied by a round of festivities. One of the customs is to give each of the servants an extra month's pay. When we paid off in accordance with the custom, we found we had 106 retainers in our entourage. It was a great surprise to learn how many people were serving us in some way.

ON February 12th, information was received that General Stilwell was en route to Chungking to take over the command of all military forces in China, Burma, and India. The Mission was to be absorbed into the new command organizations. The General arrived with additional staff officers on March 4th. He was accompanied by General Magruder, who had gone to Calcutta to meet the new commanding general, after personally supervising the final evacuation of supplies from Rangoon and the destruction of the Lend-Lease motor-assembly plant together with the motor vehicles which could not be evacuated.

General Stilwell did not stay very long in Chungking. The situation was so desperate in Burma that he decided to go there in person in his capacity as chief of staff for the Generalissimo to supervise the two Chinese armies already engaged with the Japanese. The gallant fight of the Chinese and British to hold Burma against superior numbers and the final loss of that country are well known. At the end of the campaign occurred one of the most interesting episodes of the war when General Stilwell led a party of American and British personnel on foot safely to India, after it became impossible to get back into China.

While the fight for Burma was in full swing, I was shifted from Chungking to an important town in Yunnan Province where I became chief adviser for the Chinese communications zone. The Burma Road was still open to northern Burma, and it was hoped that at least the northern part of the country could be held. It was apparent that a new highway route would have to be immediately constructed across Burma to Assam (India) if the loss of Rangoon was to be offset. Accordingly, the Generalissimo decided to close down the construction of the Yunnan-Burma Railway and give the railway construction personnel the job of building a road up the Hukawng Valley to Ledo (Assam). My good friend, Tseng Yang-fu, one of the ablest engineers in China, who had done a remarkable job in directing the Yunnan-Burma Railway work, with Major Ausland and Captain Wetzel of the Mission as advisers, was given charge of the road project. He had 3,000 men beginning the road work when the eastern end of the allied line collapsed, and Lashio was captured. The enemy did not stop there but continued into China to the Salween River, the present front line. This action effectively closed the Burma Road as China's life line and at the same time shut off all practicable highway routes to Assam.

As the Japs advanced up the Burma Road, refugees poured into our area ahead of them. We evacuated many of the American, British, and Indian refugees to India in U. S. Army air transports which were beginning to come into China with supplies for the American Volunteer Group. The panic subsided when it became apparent that the Japs had stopped at the Salween, but it was some months before the cholera which the refugees brought with them was brought under control and the surplus population moved inland.

IN July, the American Volunteer Group was inducted into our Air Forces. The A.V.G. record had been impressive. So effective had been their work that the enemy was refusing battle when the shark-mouthed squadrons approached. Hundreds of Jap planes had been downed with small losses to the A.V.G. China was justly proud of them, and they are already a tradition to the common people.

General Stilwell had placed me in charge of our interests in what was to become the American Air Base area, and for the remaining months of my stay in China I had much to do with our air operations, particularly with our relations with the Chinese and with the U. S. ground personnel.

For several weeks after the induction of the A.V.G., the loss of many of their experienced pilots who had returned to the United States and the lack of combat experience of our own squadrons caused some concern as to whether we were in danger of taking a few jolts from the enemy while our men gained experience; but such was not the case. Under the leadership of Brig. Gen. C. L. Chennault, who had trained and led the A.V.G., the transition was bridged without disaster. The American Air Force, both pursuits and bombers, took up where the A.V.G. left off in winning air battles from the Japs. In fact, they have never lost a battle. Today, with relatively few airplanes operating on interior lines behind a fine air-warning net, they have been able to strike in eastern China or in Burma at will, each time concentrated to give local superiority and usually surprising the enemy. This remarkable record is largely due to the tactical genius of General Chennault, who knows Japanese psychology and habits, and has been able to feel out and strike at their weakest points.

Toward the close of the summer, the tempo of our activities increased as General Chennault carried the war to the enemy and kept him on the defensive. Suddenly my own part in supporting Chennault came to an end when I received orders to return to Washington. I was soon on my way "over the hump" along with a load of tungsten ore. India, Iran, Africa, Brazil, and Miami were legs in the long trip by air, and eighteen days after leaving China I arrived in Washington.

My year in China was at an end. It was a year filled with experiences of the impact of war, a year which solidified my respect for the Chinese people for their five years of dogged resistance to a ruthless and barbaric foe. I came away convinced that China will never be defeated and that the last battles of this war to end Japan's aspirations to rule Asia will be won in China.

Standardized Inspection

Quality Control Methods Applied to the Acceptance of Ordnance

Lieut. R. J. Saunders *

AT the outset of the present national emergency, tremendous quantities of ordnance matériel were needed, virtually overnight. The demand for production was so great that the Ordnance Department was prepared to go to any lengths to obtain the needed matériel, adequate in both quantity and quality. Among other things, the Ordnance Department placed many of its inspectors in manufacturing plants to perform inspection which the contractors normally should have performed themselves. Government men were found assisting at the machines, in process inspection, and wherever they could aid in getting matériel produced as rapidly as possible. However, now that the initial pressure is eased and American industry is more familiar with the production of ordnance, the manufacturers are expected to assume completely their share of the inspection load. Ordnance inspectors are supposed to inspect only for acceptance.

In the Ordnance Department a program is under way which is vitally affecting the acceptance inspection performed on ammunition. As a result, ordnance inspection is becoming more efficient, Government inspectors are beginning to accept and reject on a more rational and standardized basis, rule of thumb is being eliminated, quality of accepted material is improving, and Ordnance inspection personnel are, in general, being reduced. At the same time, the responsibility of manufacturers to submit only material of satisfactory quality for acceptance is being more definitely crystallized, and greater coöperation is being obtained.

This program involves the use of economic and uniform acceptance-inspection procedures designed on a scientific "quality-control basis." At present, one of its important phases is the application of a *standard sampling inspection plan* to material which is produced in quantity and is inspected for dimensions, finishes, and other characteristics on a "go" or "no-go" basis. Most items of ammunition made by private industry fall into this category. For such items, Ordnance drawings and specifications set forth explicitly the dimensional tolerances permitted and the type of finish required. Both contractors and Ordnance inspectors understand that accepted pieces must be in conformance with the drawing requirements. In the past, however, Ordnance inspectors ordinarily have had to decide for themselves how such conformity was to be ascertained.

The new standard sampling inspection plan for ordnance changes all this. The plan sets forth criteria for acceptability, establishes the amount of inspection required to assure control over quality, and provides the inspector with a specific lot-by-lot acceptance procedure on which to operate. The plan is so designed that all manufacturers making an item face the same type of inspection and the same criteria of acceptability, regardless of where the plants are situated. Inspection and acceptability are thus standardized for the entire country. Such a system provides the contractor with a more definite and satisfactory basis on which to operate.

Ordnance inspection must be limited to the minimum necessary to assure that material, when accepted, satisfies established standards as to quality and serviceability. It is essential, particularly with the amount of material being procured during the present emergency, that Ordnance inspection be of the utmost efficiency. A high degree of efficiency is impossible, however, unless the contractor likewise places his own inspection on a sound basis. A manufacturer of ammunition parts entering into a normal contract with the Government agrees to furnish all material in strict accordance with drawings and specifications. Furthermore, he agrees to maintain a system of inspection adequate for his responsibility of submitting to the Government only acceptable material. The Ordnance Department may render assistance to expedite production but does not assume responsibility for the contractor's inspection.

IN the current inspection program, increased emphasis has therefore been placed on the obligation of the contractor to maintain his output at as high a quality level as possible. Such a quality level is normally attained only by satisfactory inspection control at the machine or assembly line, with an adequate final inspection prior to submission for acceptance. However, this is the manufacturer's problem; the Ordnance inspector is concerned only with receiving material of acceptable quality and not with what steps must be taken to obtain that type of material. In general, the Ordnance inspector does not perform inspections which change quality, such as process inspection or one hundred per cent inspection, but rather he inspects for the purpose of measuring an already existing quality.

Ammunition decides matters of life and death, and its quality must necessarily be high. Ordnance can therefore demand that ammunition be perfect. But, since this perfection cannot be reached under mass-production conditions, and since quantity may be as important as quality in winning battles, Ordnance may have to accept material which is a degree lower than perfect. This situation was discussed in detail by G. D. Edwards in an article entitled "Quality Control of Munitions," published in the November-December 1942 issue of ARMY ORDNANCE (Vol. XXIII, No. 135, p. 482).

Realizing that material submitted even by the best manufacturer will be slightly less than perfect, the Ordnance inspector has one of two alternatives. If absolutely no defective material can be tolerated, Ordnance can only resort to complete inspection of every single piece accepted. This is the case for certain articles; still, for most articles, one hundred per cent inspection by the Ordnance Department is neither possible nor practicable from an economic point of view. Many ordnance items have one or more dimensions or other characteristics which, if below standard, result merely in the defective articles functioning with less than one hundred per cent efficiency. There are other defects (such as bad threads on ammunition metal parts) which result merely in the defective components being rejected during loading and assembly or some other subsequent operation. For many

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Size of Inspection Lot		500–799		800–1,299		1,300–3,199		3,200–7,999		8,000–22,000	
First Sample Size		50		75		100		150		200	
Second Sample Size		100		150		200		300		400	
Acceptable Quality Level (Per cent defective) *Major*	*Minor*	Acceptance Numbers C_1	C_2	Acceptance Numbers C_1	C_2	Acceptance Numbers C_1	C_2	Acceptance Numbers C_1	C_2	Acceptance Numbers C_1	C_2
0–.05	.....	..	..	..	..	..	..	0	1	0	2
.06–.15	0–.05	..	..	..	..	0	1	0	2	0	3
.16–.25	.06–.15	..	..	0	1	0	2	1	3	1	4
.26–.50	.16–.25	0	2	1	2	1	3	2	4	2	7
.51–1.0	.26–.50	1	3	2	4	2	6	3	9	4	11
1.1–2.0	.51–1.0	2	4	3	5	3	8	5	13	6	16
2.1–3.0	1.1–2.0	3	5	4	8	5	11	7	18	9	24
3.1–5.0	2.1–3.0	4	10	6	14	8	19	11	28	14	37
.....	3.1–5.0	5	12	7	17	10	23	14	33	18	44

"ACCEPTANCE NUMBERS" FOR LOT-BY-LOT INSPECTION

such defects, the cost of one hundred per cent inspection in man-hours and delayed delivery makes it imperative that acceptance be based on a sampling inspection.

For each type of material to which the standard sampling plan is applied, one minimum acceptable quality level (expressed as a maximum allowable fraction nonconforming) is established for the entire Ordnance Department. Such "acceptable-quality levels" are fixed, first, upon what is required by our troops and, secondly, upon what is producible. Consideration is also given to how much material is needed, how much can be produced, and what the possibilities are of improving quality from some or all of the manufacturers. After an acceptable level of quality is established, certain producers may, of course, find that they are operating at a level lower than is acceptable. In such cases, the contractors can improve quality either by instituting better control over the production process or by maintaining a tighter final inspection. The manufacturer's inspection is considered as a portion of his process and as being, in a large measure, able to control the quality of the material presented to the Ordnance Department. On the other hand, if the manufacturer does not improve his quality, he will find a great deal of his material rejected.

THE standard sampling inspection plan is so designed that, having established an acceptable level of quality, there is assurance that lots of material containing the allowable number of defectives, or less, are accepted. As the quality of material becomes worse than the acceptable level, that material stands an increasing chance of being rejected. In addition, a further protection against the acceptance of poor material is secured by maintaining a constant check on the quality of the material submitted by the contractor.

To evaluate quality adequately and to obtain such assurance, the Ordnance inspector *must* examine relatively large samples—large in terms of actual numbers rather than large as a percentage figure. For items produced in quantity, samples of from 50 to 1,500 normally are required to evaluate the quality of a batch or inspection lot of material.

Still, Ordnance inspection is limited, on most ammunition items, to a small percentage of total production. A manpower shortage exists; satisfactory inspectors have been increasingly difficult to obtain; existing gages and other types of inspection equipment must be used to the fullest advantage. Ordnance inspection and acceptance of ammunition, therefore, must be in relatively large batches or inspection lots in order that large samples can be obtained and quality accurately evaluated. For an inspection lot of 10,000, a sample of 500 amounts to only five per cent inspection; yet the quality of these 10,000 articles is ordinarily determined with sufficient accuracy by such a sample. On the contrary, a sample of five per cent from an inspection lot of one hundred normally would tell very little about the quality of that inspection lot.

FURTHERMORE, with acceptance and rejection by large inspection lots, a manufacturer becomes acutely aware of his responsibility for producing quality material. With acceptance and rejection on a tray-by-tray, "tote box by tote box," or other small-unit basis, the contractor does not feel completely the effect of having material rejected; a small amount is returned every hour or every day, and the situation assumes an air of normality. On the other hand, with acceptance based on large inspection lots, a manufacturer's whole production may be accepted for a week or more, but the single inspection lot which is rejected may represent an entire day's work.

With sampling inspection, only by large samples from large inspection lots can this nonacceptability be determined with any degree of assurance. The Ordnance inspector properly informs the manufacturer that in the inspection lot submitted he found a larger proportion of defective pieces than allowed and that, as a result, he must return the material for such action as is necessary to improve the lot's quality to the acceptable level.

If a manufacturer states that because of his flow of production he does not have the space or time to allow material to accumulate into large inspection lots, the Ordnance inspector justifiably states that acceptability of the material can be determined only after a sufficient number of pieces have been examined. If the manufacturer wishes to paint, pack, or move the material prior to that time, he may do so at his own risk. At first glance, such an attitude may appear rather severe, but if a producer submits material at the acceptable quality level, or better, he has little to fear. It is only when he falls below this level that Ordnance returns the material.

The Ordnance inspector is provided in the standard sampling plan with definite criteria for acceptance by large inspection lots. Acceptance of an inspection lot of material usually involves a number of separate inspections, each covering one or more dimensions or other characteristics for which

tolerances are prescribed. But in establishing criteria for acceptance, a piece is considered equally defective by the Ordnance Department whether it contains one defect or more than one. If it contains any defects at all, the piece does not meet the requirements established for it and must be considered as a "defective." In the standard sampling inspection plan, defects are therefore grouped together and quality determined in terms of the number of defectives.

SUCH a procedure simplifies both inspection and the determination of acceptability. In grouping defects, the Ordnance Department, of course, has had to consider that for any one item or piece there may be different degrees of seriousness for different defects. Some dimensions or other charactristics, if defective, may result in death or injury to our own personnel. Other defects may cause failure of a component to function as expected. Still other defects may cause difficulties in future processing of the part. Because of these degrees of seriousness, it has been found necessary to group characteristics into three categories rather than one. These categories are termed, respectively, critical, major, and minor.

The seriousness of critical defects is such that *none* can be tolerated in accepted ammunition. To make as certain as possible that no critical defects exist in ammunition accepted by the Ordnance Department, one hundred per cent Government inspection is required for defects of this type. This means that the contractor must also inspect every piece for critical defects before submitting it for acceptance and that the Ordnance inspector will reinspect every piece for these same defects before accepting it. Sampling inspection on this type of defect is not adequate.

For major and minor defects, sampling inspection is satisfactory. As the distinction between these two categories is one of the tactical seriousness of the defects, tactical considerations may require different acceptable quality levels.

With acceptable-quality levels and classifications of defects standardized, the Ordnance inspector knows what is acceptable and what the seriousness of defects is. However, in taking his sample, the inspector may determine that a lot is definitely good or definitely bad, or that the sample is on the border line and acceptability of a lot is indeterminate. To avoid the possibility of confusing borderline cases, the plan requires the use of a double sampling system. If the first sample definitely indicates the material is acceptable or unacceptable, the inspector takes the action indicated; but if the first sample leaves doubt as to acceptability, the inspector takes a second sample and acts on the basis of both samples.

The details of the inspection plan—that is, sample sizes and acceptance numbers—are given in a table similar to that shown on page 291. In the table, various "acceptance numbers" are tabulated for each size of sampling corresponding to any set level of quality from zero per cent defective to five per cent defective for both major and minor defectives. (Critical defectives require one hundred per cent inspection and the acceptance number is zero.) C_1 is the number of defective pieces allowed in the first sample. If a second sample is required, C_2 is the number of defective pieces allowed in both the first and second samples combined. If the latter number is exceeded, the inspection lot is returned to the contractor for reinspection.

The method of operation followed by the Ordnance inspector can perhaps best be set forth by a specific example. The Ordnance inspector is told by higher authority what dimensions and other characteristics are in the critical, major, and minor categories and is given the acceptable levels of quality, which, for illustrative purposes, might be 0.56 per cent defective (99.44 per cent good) on major and 1.1 per cent defective (98.9 per cent good) on minor characteristics. Those dimensions or other characteristics in the critical category are inspected one hundred per cent by him either before or after his sampling inspection. The contractor presents for acceptance material in inspection lots of 5,000. With these facts known, the plan which the Ordnance inspector follows is governed by the table.

For an inspection lot of 5,000, the table indicates that a first sample of 150, and a second sample of 300, if necessary, is to be examined. With this stipulated and the acceptable quality levels defined, the acceptance numbers are determined for major defectives and for minor defectives. With an inspection lot of 5,000 and an acceptable quality level of 0.56 per cent for major defectives, the acceptance numbers are: $C_1 = 3$ and $C_2 = 9$. For minor defectives, another set of acceptance numbers is found. By referring to the column titled "Minor Defectives" and reading across at 1.1 per cent defective, a C_1 of 7 and C_2 of 18 are indicated for inspection lots of 5,000. A statement of the size of the inspection lot, the size of the first and second samples, and the acceptance numbers for major and minor defectives constitutes the Ordnance inspector's plan of inspection. His specific procedure is as follows:

1. He selects a sample of 150 from the 5,000, making certain that it is completely representative of the entire inspection lot.

2. He inspects the sample of 150 for all major and minor characteristics. If no more than three pieces are found defective because of major characteristics and if no more than seven are found defective because of minor characteristics, he accepts the inspection lot without a second sample.

3. He rejects the inspection lot if the sample of 150 is found to contain more than 9 major defectives or more than 18 minor defectives. Rejection may be caused by either condition or by both together.

4. If the sample of 150 contains more than 3 major defectives but not more than 9, or more than 7 minor defectives but not more than 18, he selects a second sample of 300 from the 5,000, again making as certain as he can that this additional sample is also completely representative of the entire inspection lot.

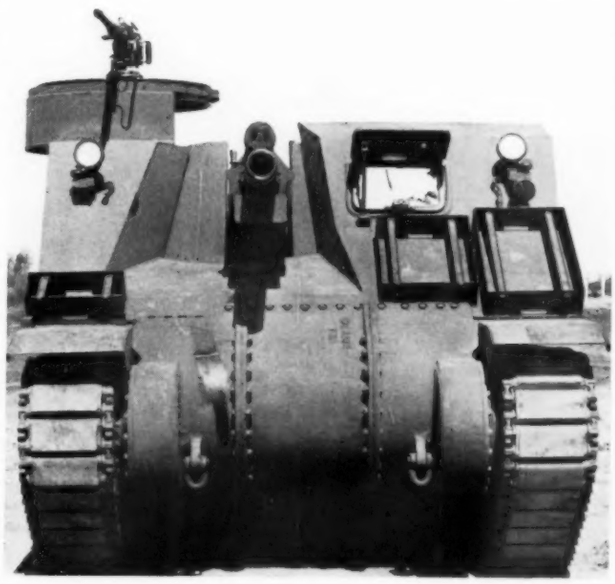
5. He examines the second sample only for the category of defects causing rejection of the first sample, and he accepts the inspection lot only if the first and second samples combined contain no more than nine major defectives or no more than eighteen minor defectives, depending upon which type of defect he is inspecting for.

6. He returns each rejected inspection lot to the contractor for one hundred per cent reinspection and, upon resubmittal, reinspects it himself in accordance with the same plan used for initial inspection.

With this plan of inspection, the Ordnance inspector does not conduct his work according to rule of thumb. He selects samples of a definite size each time, subjects them to the same kind of inspection day in and day out, and works on one acceptable level of quality. Furthermore, at all other plants producing the same type of item, inspection is on the same basis. There is thus achieved a uniformity in ordnance inspection which obviates the chance that an item from one manufacturer will be accepted while the same item of comparable quality from another will be rejected.

Self-Propelled Artillery

WHEN the American-made M7 armored tank destroyer blew a gaping hole in German Marshal Rommel's line at El Alamein, many seemed to think that the Ordnance Department had produced a "secret weapon" almost overnight. The secret, however, lay in the fact that an entire regiment of the British Eighth Army had been armed with the M7 without the enemy's knowledge. While neither "secret" nor "new," this tank destroyer was a unique weapon and consisted of the 105-mm. howitzer mounted on the M3 medium tank chassis to which a "pulpit" carrying a caliber .50 air-cooled machine gun had been added (see illustration opposite). But it was not created without months of planning, trial, development, and manufacture.



The "tank destroyer," as such, is new to this war, but the Ordnance Department began to develop self-propelled artillery twenty-seven years ago when the mud and heavy guns of World War I made the tracklaying tractor necessary as a prime mover. Ordnance then conceived the idea of mounting the gun directly on the tractor and in 1916 sponsored the design and manufacture of two self-propelled 3-inch anti-aircraft guns which were delivered for tests in 1917 and 1918. The tests, while revealing many faults, showed that heavier guns could be so mounted, and a war program for self-propelled artillery was laid down, resulting in the manufacture of twenty carriages, some of which were completed after the Armistice.

These war-time mounts were the Mark I, for the 8-inch howitzer; Mark II, for the 155-mm. G.P.F. gun; Mark III and III, M1, for the 240-mm. howitzer; Mark IV, for the 240-mm. howitzer; Mark VII for the 75-mm. gun. In reviewing the tests of this new artillery, the Westervelt Board, while pointing out the many defects in the crude pilot models, indicated where improvements could be made and recommended that motor carriages for the 75- and 155-mm. guns "should be immediately developed to the utmost."

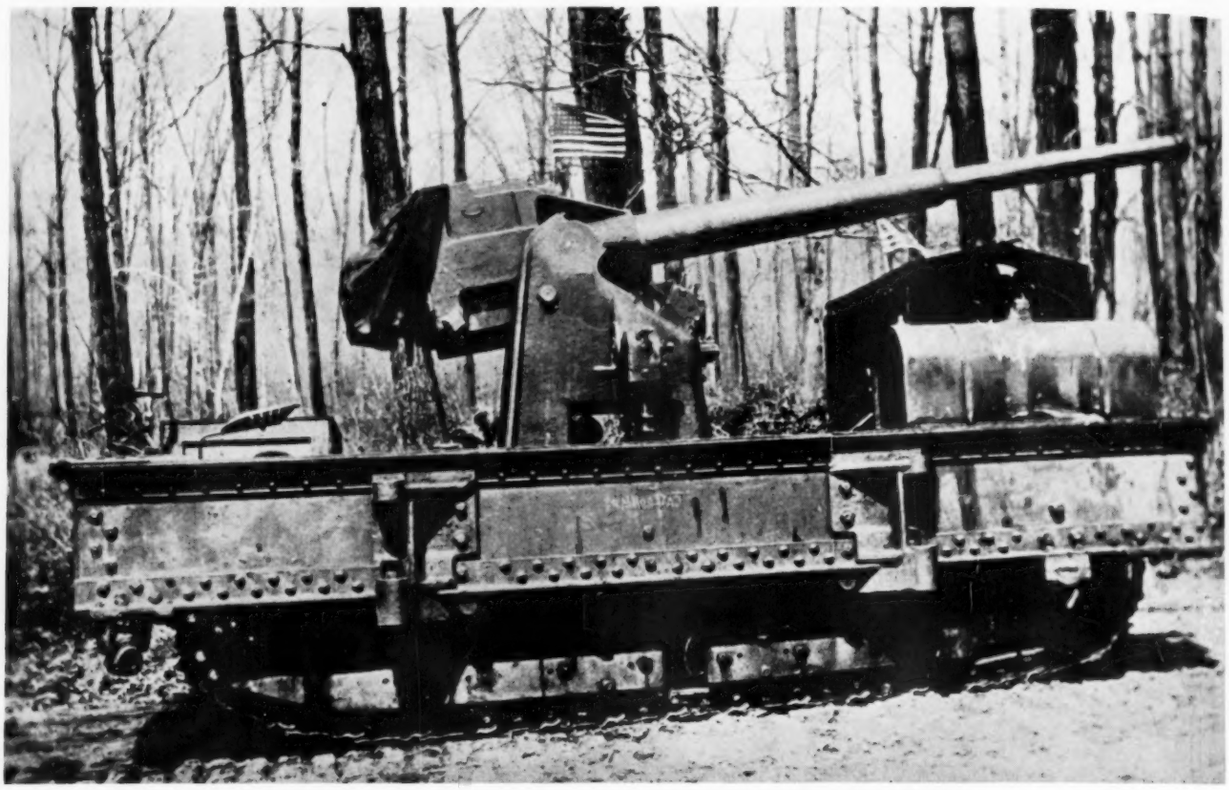
Development of self-propelled mounts was continued after the war, and motor carriages Marks VI, IX, and X were designed. But soon appropriations for this purpose began to grow less and less, and, in a number of cases, Ordnance officers used their personal funds to finance the experiments which, they were convinced, would prove the value of self-propelled artillery. However, this was not enough to bring the early models to perfection, and they were rejected by the using arms. As a result, development of self-propelled artillery stopped in 1925.

In 1939, European war clouds gave a new impetus to the project, and development began once more, influenced by the experiments of the past but even more so by the German *Panzer* divisions which rolled over Poland and France soon afterward. In November 1941, improvised tank destroyers of the First Army proved the soundness of this weapon in large-scale maneuvers in the South. Shortly thereafter, fifty half-track trucks mounting 75-mm. guns were rushed to the Philippines, and their effective work against Japanese landing parties and on the retreat to Bataan swung the self-propelled program into high gear.

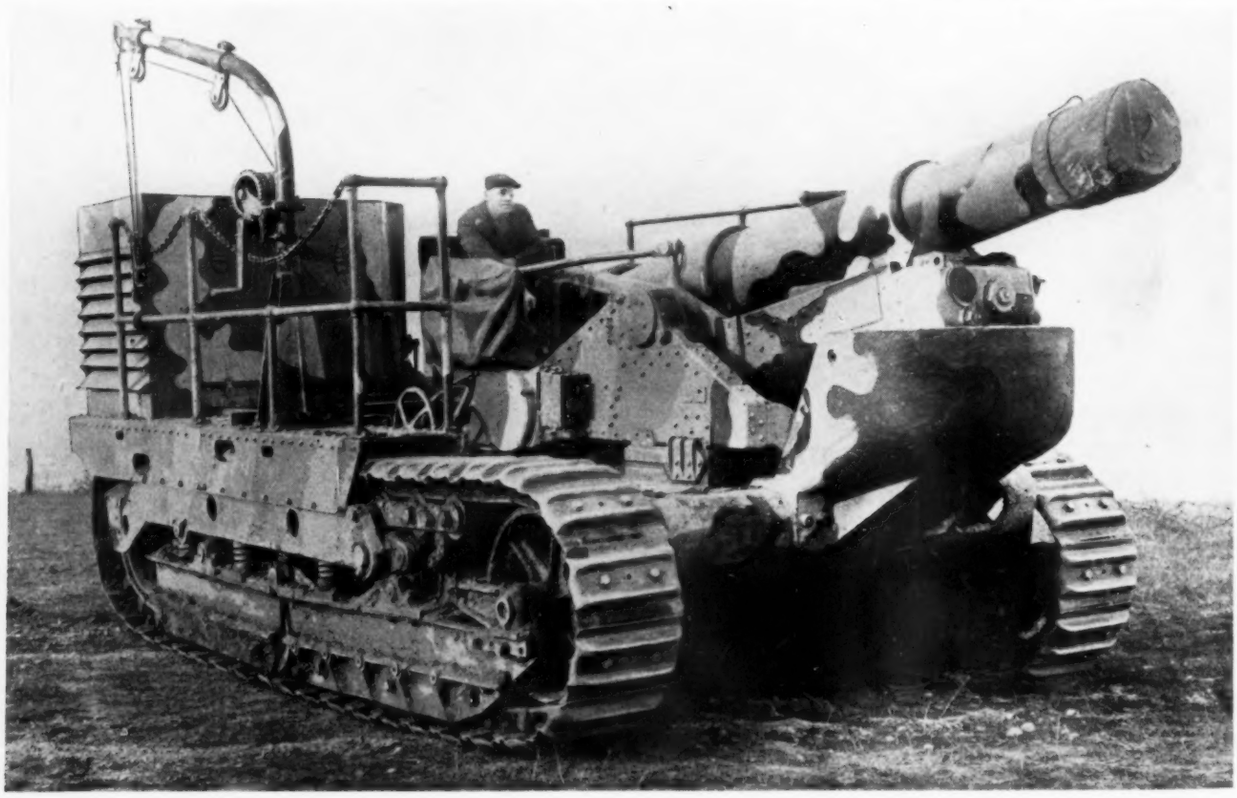
In battle, the tank moves across country against hostile personnel and strong points; it must be heavily armored and is comparatively slow. The tank destroyer, however, strikes only at the tank. It seeks out the tank, maneuvers for position, conceals itself, and ambushes the tank when possible. Hence the destroyer must have three prime characteristics: first, it must have superior gun power; secondly, it must be faster than the tank to beat it to position; thirdly, the destroyer must present a small target to the enemy.

For invaluable assistance in securing data and photographs of the self-propelled artillery illustrated in these pages, ARMY ORDNANCE makes grateful acknowledgment to William F. Beasley, chief engineer, Tank and Motor Transport Branch, Ordnance Department Technical Division, U. S. Army.

Pioneer Motor Carriages

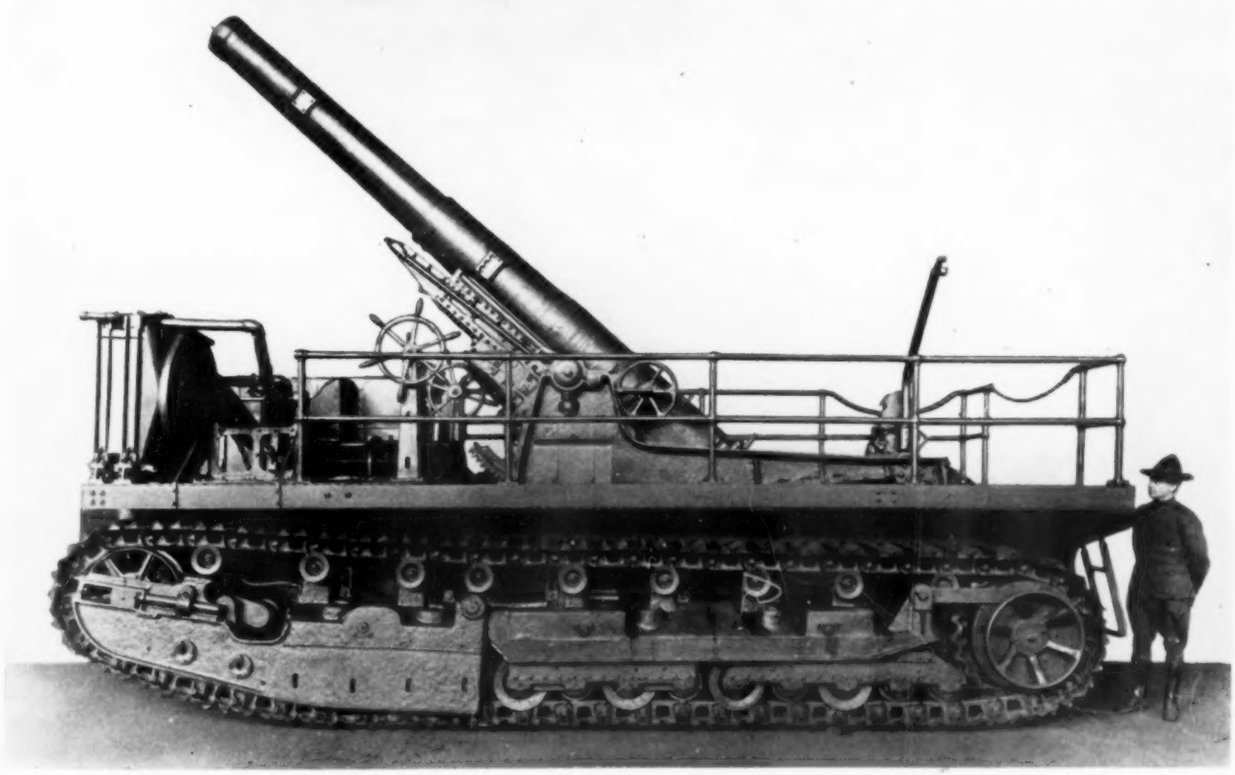


The self-propelled mount for the 3-inch antiaircraft gun, shown above, was the first motor carriage sponsored by the Ordnance Department. Planned in 1916, it was delivered for test in 1918. The Mark I motor carriage for the 8-inch howitzer is shown below. It was the only mount on the World War self-propelled program completed before the Armistice.

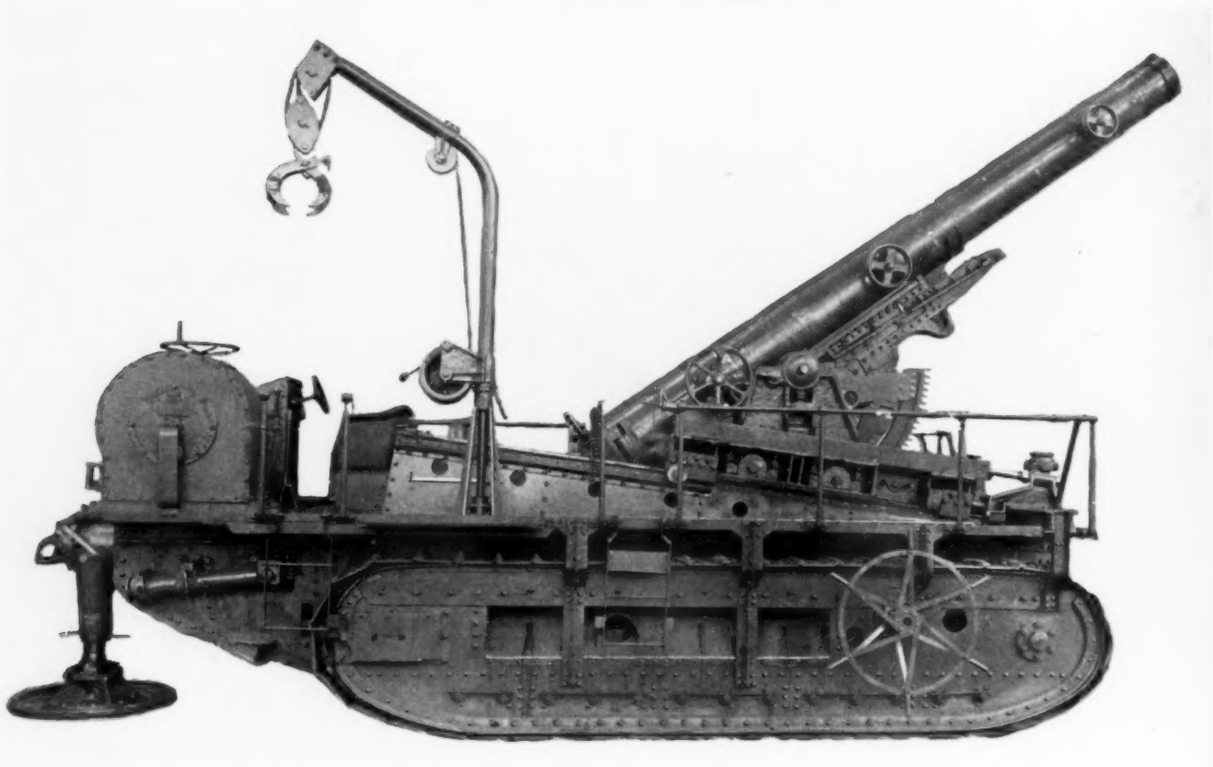


Early Self-Propelled Mounts

The Mark II mount for the 155-mm. G.P.F. gun, shown above, was built in 1920. It weighed, with gun, 19,860 pounds, was 118.6 inches wide, and had a top speed of 5.4 miles an hour. The Mark III motor carriage for the 240-mm. Schneider howitzer is shown below. With howitzer, it weighed 106,500 pounds and had a speed of 3.5 miles an hour.

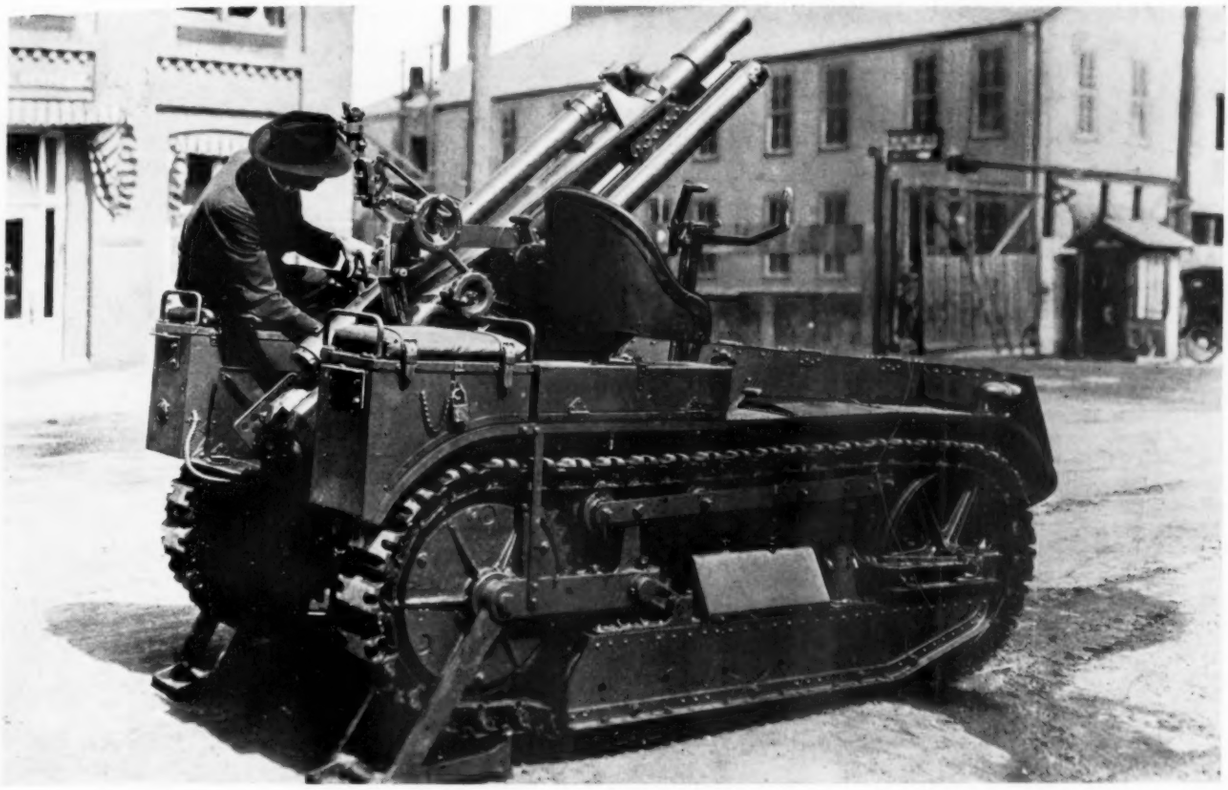


Motor Carriages, Marks IV and VI



The Mark IV self-propelled 240-mm. howitzer, shown above, was built in 1919 from the design of the French company of St. Chamond. It was electrically driven, a power unit being coupled to it when traveling. The Mark VI motor carriage, Model 1920, for 75-mm. gun or 105-mm. howitzer, is shown below. It weighed 13,200 pounds and traveled at 14 m.p.h.

Motor Carriages, Marks VII and IX



The 75-mm. self-propelled gun, Mark VII, shown above, was made in 1918. It weighed 10,600 pounds and had a speed of nearly 10 miles an hour. The gun had an elevation of 45 degrees and a range of 8,770 yards. The Mark IX motor carriage, Model 1921, for the 155-mm. gun or 8-inch howitzer, shown below, weighed 45,000 pounds, was 110 inches wide.

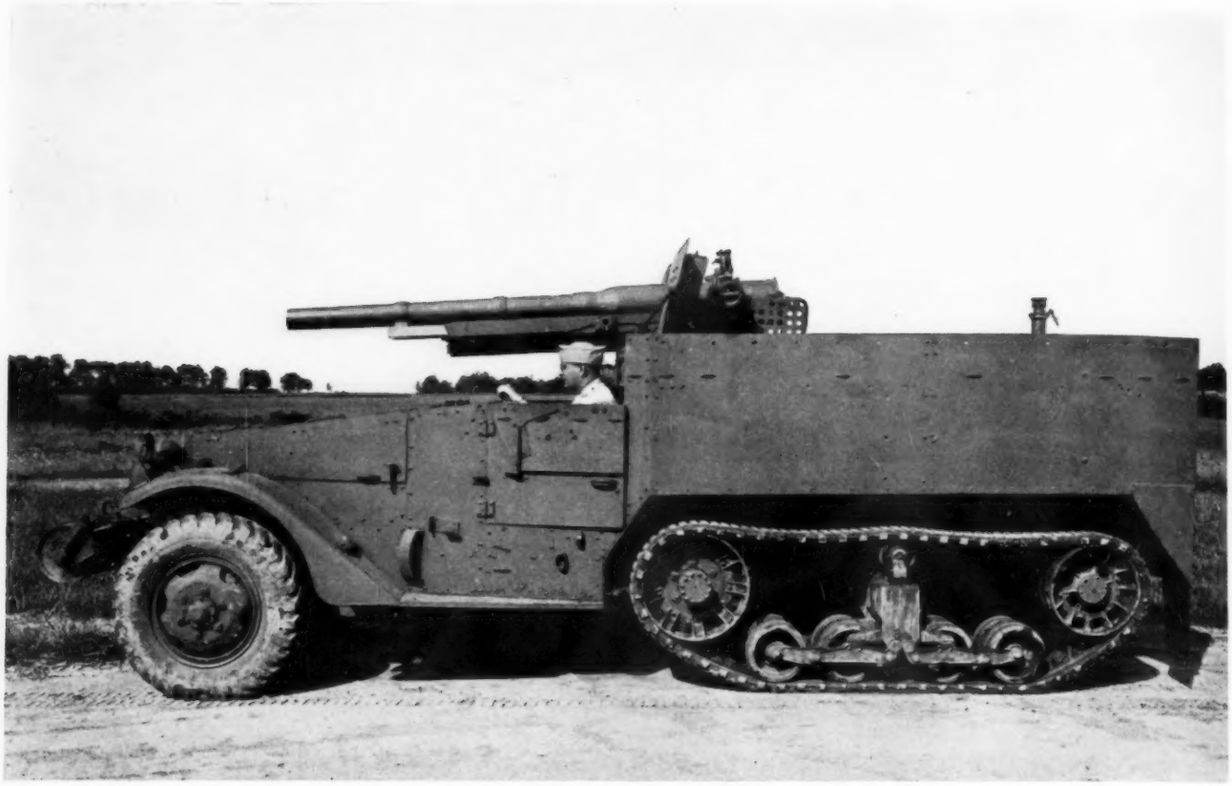
Forerunners of Today's Automotive Artillery

The Mark X motor carriage for the 4.7-inch gun, shown above, was the only self-propelled mount for corps artillery completed in the postwar period. It was delivered to Aberdeen Proving Ground for test in 1924. The Christie convertible carriage, Model 1920, for the 155-mm. gun is shown below. It could operate on wheels or use tracks in rough terrain.

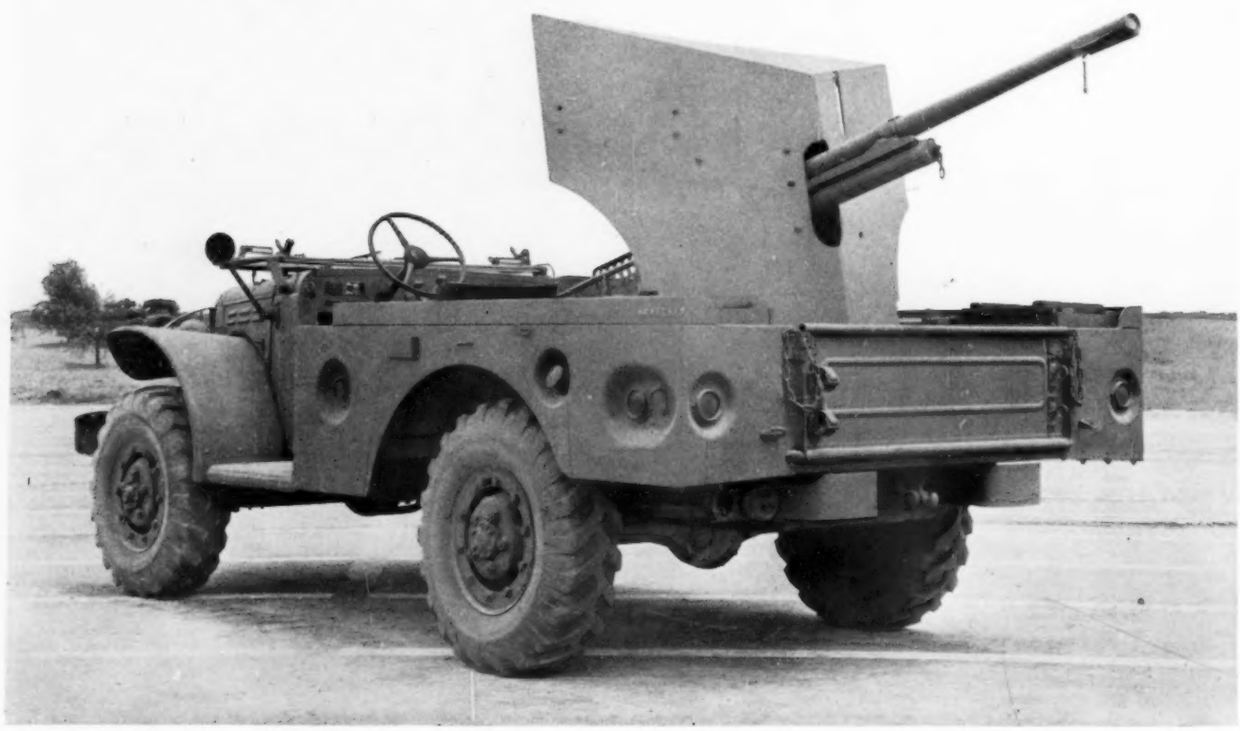
Tank Destroyers of the Present and Future

The Army's latest tank destroyer, the M7 shown above, is the weapon that helped break Marshal Rommel's El Alamein line. It carries a 105-mm. howitzer and a cal. .50 air-cooled machine gun mounted on the M3 medium tank chassis. Below is an artist's conception of a self-propelled gun of the future—a 155-mm. weapon on a tracklaying chassis.

Fast Modern Tank Killers



Shown above is the Army's tank destroyer M3—a 75-mm. high-velocity gun mounted on a half-track. Destroyers of this type slowed the Japanese invasion of the Philippines and proved the soundness of the tank-destroyer idea in action. Below is the tank destroyer M6—a 37-mm. antitank gun mounted on a ¾-ton truck which can negotiate almost any type of terrain.



Ordnance in Action

A Critique of Maintenance and Supply Functions in the Field

Col. Harold J. Conway *

MANEUVERS were held recently by three mechanized and armored divisions supported by an air-support command on ground which only seventy-five years ago was won and lost by merely "getting there fustest with the mostest men." In those days, instead of worrying about the availability of high-octane gasoline, horses could and did exist on the land. In all probability, a full battalion's daily requirements of ammunition then weighed less than the load carried by a single bomber today. The writer was attached as the official Ordnance observer for the Ordnance Military Training Division, Office of the Chief of Ordnance, during these maneuvers held by the Second Army on the site of the Civil War battlefields near Lebanon, Tenn.

The Ordnance observer of Civil War days probably had an easy time of it. Ordnance then consisted of rifles, revolvers, a few types of muzzle-loading artillery, and a limited variety of ammunition. Today, for each job there are numerous weapons, all intricate, requiring highly trained personnel for proper maintenance and supply. For each weapon there are various types of ammunition, each for a particular mission. The job formerly well done by horses is now performed by tanks, prime movers, personnel carriers, and other wheeled, track, and half-track vehicles. Artillery fire has changed from point-blank range to today's indirect and anti-aircraft fire; instruments which were unthought of a few years ago have now become the Army's mechanical brains. Gasoline, oil, and electronic tubes have changed modern warfare. The Ordnance soldier is now also an M.D.—a mechanical doctor—for the supply and maintenance of everything in the Army that rolls, fires, or is fired.

The well-known axiom that the "impetus of supply must come from the rear" was never more forcibly brought out than at these maneuvers. Many readers will probably take for granted that this means only that constant supplies are being brought up, but there is much more entailed. The using customer, the unit commander, also has a responsibility. From an Ordnance officer's standpoint, this means that unit commanders will make their immediate and future needs known as early as possible in all types of action, and that the using troops should perform as much of the maintenance function as possible themselves. During combat there is always more than enough third- and fourth-echelon maintenance work to be accomplished by the maintenance units.

A brief description of first-, second-, third-, and fourth-echelon repairs may be of interest. For comparison, first- and second-echelon work by the using troops is similar to the repairs that the average driver could make to his own automobile, or that maintenance furnished by the repair truck sent out by the local garage; that is, repairs actually made on the spot of breakdown. Third-echelon work is the replacement and adjustment of mechanical parts and engines by Ordnance mobile repair units. This repair is similar to that rendered by the commercial service garage. Fourth-echelon repair is rendered in the base shops equipped for major overhaul. This echelon of maintenance is similar to a factory overhaul of a major item. A step forward would be taken should the using troops become fully acquainted with their own capabilities on the battlefield with reference to repair and with those services furnished by the Ordnance maintenance unit to assist them in keeping their guns firing and motors rolling. This can be learned more economically in training than through the hard lessons of battle experience.

At a casual glance, this may appear to be splitting hairs and probably an attempt to evade responsibility for maintaining equipment; but we must not overlook the fact that responsibility for supply and maintenance rests as much with the unit commander as with the service agency, and it is the basis on which personnel and equipment are allotted to perform any task for both.

HAVING observed other maneuvers, including one by similar units over the same territory a year ago, it is this observer's opinion that additional thought and training must be given to ammunition supply in the Armored Force, plus a development of a definite mobile scheme of supply for that branch, particularly in the division. At present there is no standard procedure. Also urgently needed is a standard pattern for the servicing of armament matériel casualties. There appears to be a slight overemphasis in all ground-force units on mechanized or rolling maintenance where care of the gun and its supply of ammunition should probably have a higher priority.

It is noted that there still seems to be some duplication in the field of automotive-equipment maintenance, a service recently acquired by the Ordnance Department from the Quartermaster Corps. It must be impressed that there is no line of demarcation on this subject. The third and fourth echelon of maintenance of all rolling stock, track-laying or wheeled, is now an *Ordnance function*. While the writer is unable to say just what effect this will have in the Quartermaster set-up, it is quite obvious that some adjustment must be made in the Ordnance staff sections and organizations to compensate for this additional task. It is known that considerable thought and action are being taken on this matter by the Office of the Chief of Ordnance.

During maneuvers it is difficult to visualize the amount of ammunition necessary, the space occupied, the labor entailed in its storage and protection, and the distribution required in actual combat. The average staff officer has no conception of the tremendous amounts necessary to be handled and the necessity for proper dispersal from air attack and other dangers, such as a tank attack.

More actual simulation of tonnages to be handled and areas covered to accommodate ammunition should be employed. Divisions and other units should be given ammunition credits in more than one supply point to provide a reserve in case of mechanized capture or aërial destruction of their allotted supply. One ammunition supply point was captured in this maneuver, leaving the units without ammu-

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Signal Corps

ORDNANCE PROCURES, MAINTAINS, AND SUPPLIES THIS 155-MM. GUN AND ITS 7½-TON PRIME MOVER

nition—a circumstance that could have been avoided by such a plan.

All are naturally interested in the air-ground operations previously mentioned. The air groups furnished were observation, light- and dive-bombardment groups—the direct-support units. For additional or heavier types of mission aviation, higher echelons will be called on as the situation warrants or develops.

This observer notes with a great deal of satisfaction that Air Force Regulations for the supply and maintenance functions for the Air-Support Command logically differentiate between operations in the continental limits of the United States and in actual task-force operations. Procedure has been outlined to compensate for the unusual conditions which may and probably will be found on foreign shores due to variances of terrain and availability of existing bases from that found in the continental limits of the United States with its more permanent installations.

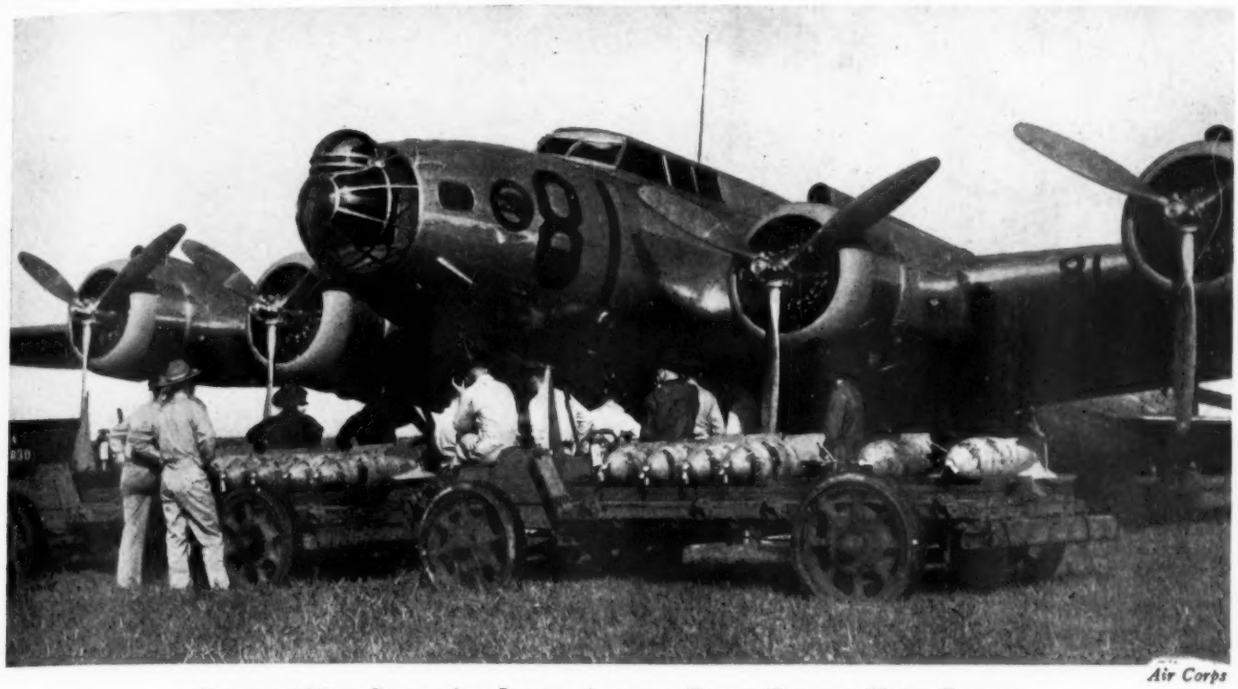
Fully agreeing that Air Force flexibility must be maintained by separate installation when necessary but realizing, on the other hand, that an Ordnance ammunition depot handles the ammunition for all other branches including the Armored Force, unless an unusual situation should arise, it would seem that, to avoid duplication of supply points, there is no reason why the same personnel should not also handle Air Force ammunition in joint S.O.S. supply installations. The fact that Ordnance makes ammunition for the Air Force, as well as all other branches, would indicate its ability to store and supply this ammunition. This is said with no intention of recommending the removal of any function from its proper place but to avoid duplication of supply installations in task-force situations where facilities are limited. The average Ordnance officer and soldier fully realize that little is heard of him in the glowing radio and newspaper reports. He is willing to bask in the reflected glory of an over-all job well done in which he has contributed his bit.

An obvious step forward has been made in the organization of an Air Service Group which handles all the third-echelon maintenance functions for air supply in addition to other assigned duties in backing up two combat groups operating from eight dispersed airdromes. In the Air Service Group will be found three Ordnance companies, filling the gap between these airdromes and the Air Force general and ammunition depots. It is strongly recommended that these units be provided sufficient transportation to handle the ammunition and Ordnance general supply from the ammunition and Air Force depots forward to these airdromes.

AMONG other items for consideration is the shortage of Ordnance staff officers in the Air Service Group organization. Increasing the Ordnance unit commander's duties to include both staff and command functions under present conditions does not permit the necessary attention to his important command jobs, such as armament and motor maintenance and the operation of his organization.

The question of the spare parts formerly handled by the Quartermaster Corps and still in their hands to a certain extent at the time of maneuvers was discussed, and protection against ground attack on airdromes was also given serious consideration. It was recommended that parts supply be placed as soon as feasible with the Ordnance Department and that standardization on one system be stressed. It was generally agreed that the air-base security battalion equipped with caliber .30 and .50 machine guns, 75-mm. self-propelled artillery, and rifles for the protection of the dispersed airdrome is essential, but here an additional ammunition problem presented itself for Ordnance. If the security battalion should draw from adjacent ground-force installations or be supplied by the Air Forces organization, again duplication of supply effort must be avoided.

While it is felt that there will be no difficulty in solving this problem, it is believed that an organization for the



Air Corps

ORDNANCE-MADE BOMBS ARE LOADED ABOARD A FLYING FORTRESS HEAVY BOMBER

protection of Ordnance service units, such as depots, maintenance centers, and bivouacs in the combat area should be vested in a separate unit provided by a higher headquarters. It is hardly in accord with good management to use highly skilled maintenance personnel for lookout and guard duty, although they should be armed and trained in the use of their reserve weapons. This problem is a serious unsolved one. At least a warning service should be provided by higher authority for the service areas. Among other pertinent items brought out by the maneuvers are the following:

1. *The need of a mobile ammunition supply system for the Armored Force.* Here the problem entails the consideration of the amount of ammunition the vehicle can and will be permitted to carry, how long this unit of fire will last in combat, and the time and space arrangements made for additional supplies coming up under combat conditions.

2. *The need of definitely establishing the line where organizational or combat-unit maintenance ends and Ordnance maintenance begins.* Naturally, consideration here must be given to the training and skill of the using personnel and the tools available. We also must think of the problems of combat fatigue and the time available for this servicing in the using unit. My recommendation would be that a maintenance battalion in the armored corps should back up the Ordnance maintenance battalion of the armored division, doing that work which the advanced divisional repair units cannot handle in the allotted time under the stress of rapid movement plus combat fatigue. It is believed that all work requiring more than four hours should be handled by follow-up corps maintenance, not by the division maintenance battalion.

3. *Simulation of ammunition and other supplies in accordance with actual tonnages and space.* This I have found to be unsatisfactory, particularly due to the fact that the ammunition depots and general-supply depots visited, plus tonnages to be handled and transportation to handle this tonnage, by no stretch of the imagination duplicated what would be needed in combat. Without ammunition you cannot fight.

4. *Supply of spare parts.* These unit replacements should be handled as much as possible through the chain of supporting maintenance units, even though they are not normally in the chain of supply. Units that support each other with actual maintenance can well do the same with spare parts. To the writer, spare parts and maintenance are on a common basis. Without spare parts, maintenance would be impossible, so there is no reason to make their procurement complicated or difficult. A single system of stocking which leads toward ease of identification and maximum interchangeability should be stressed in all spare-parts supply.

5. *Training of Ordnance officers and enlisted specialists.* A great deal of difference was noted in the skill of the personnel who had had the opportunity of attending Ordnance schools. It is recommended that all Air or Ground Forces units make use of their allotments for the specialist training of their personnel with the Ordnance Military Training Division. Due to the limited supply of equipment, centralized training under the supply service concerned will produce the best technically trained individuals.

The highly commendable attitude between Ordnance and line officers in the field has become increasingly obvious. The willingness, initiative, and state of training of Ordnance staffs and organizations has convinced me that there should be no uneasiness on the part of field commanders in so far as their Ordnance functions are concerned. As soon as a *single supply system,* understood by the using customer and his supporting agency, has been outlined and the problem as to where organizational maintenance ends and Ordnance maintenance begins has been decided, either by maneuvers or combat experience, the job of defeating our enemy will have taken a long step forward. Rolling mechanical maintenance cannot be overstressed, but care of *arms* and ample supply of *ammunition* will win more battles. Ask the units which were at Bataan or those now in the Solomons.

Toluene for Japan's Explosives

The Captured Oilfields of Borneo Provide a Rich Source

B. Orchard Lisle*

WHEN the Japanese took over military control of the prolific oilfields in the Netherlands East Indies, they obtained something more than another and important source of petroleum—they obtained a vital supply of raw industrial chemicals to ease their hard-pressed processing plants in the homeland. Borneo crude, in particular, is characterized by its unusually large aromatic content and contains not only a remarkably high proportion of high-octane gasoline suitable for aviation fuel base stock but also a substantial percentage of toluene and xylene, as well as higher aromatics.

Production of explosives is believed to have been one of the major bottlenecks in the Japanese preparations for war, and her coal-tar industry was not capable of sufficiently rapid expansion to satisfy the Nipponese war lords. It is not surprising that Japanese industrialists, such as Mitsui and Mitsubishi, for long closely associated with officials of the Tokyo Diet, had been endeavoring to obtain at least a financial foothold over some of the potential new petroliferous properties in Borneo. Japanese diplomats for several years alternated between threatening the Netherlands Government and offering to buy outright the entire Netherlands East Indian territory—to no avail.

In part, this great desire to obtain Borneo oil was due to the wish to supplement Japanese production of industrial chemicals with the aromatics present in this particular type of crude petroleum. Any military action must be supported with an adequate supply of explosives, and the logistics in this regard may have caused more headaches in high military and naval circles in Tokyo than did the fuel problem.

Chief of the high explosives employed in modern warfare is trinitrotoluene—better known as TNT. There are a number of other explosives which can be and are used in various ways, but trinitrotoluene is generally preferred because of its high power, great stability and dependability, and its safety during handling. Since TNT is derived expediently by nitration of toluene, the aromatic crude oils of Borneo must have appeared particularly inviting to covetous Japanese eyes. On the other side of the picture, toluene finds numerous applications in the chemical industries for the manufacture of dyestuffs, as a thinner for paints and lacquers, and as a solvent. Furthermore, research long ago indicated that toluene was a very important constituent of aviation gasoline and that its presence in motor fuel improved the antiknock quality to such an extent that production from petroleum of pure toluene as a raw material was abandoned by the oil industry in favor of its direct employment as gasoline base stock.

There is little doubt that the non-waxy high-gravity crudes of Borneo are probably the most prolific source of toluene in the world. These have an amazingly high aromatic content—benzine, toluene, and higher homologues, naphthalene derivatives, cyclic hydrocarbons, decalin, and tetralin are found, and the crudes consist approximately of equal parts of aromatics (largely toluene), naphthalenes, and paraffins. The toluene fraction of Borneo crude was used for the manufacture of trinitrotoluene as far back as World War I, not only in England but also in France, Holland, and Germany.

Simple fractionation of Borneo crude now under the control of the Japanese will provide our enemies with one of the cheapest, easiest, and most satisfactory sources of toluene for the manufacture of high explosives. With slight adaptation, the existing petroleum distillation apparatus in Nipponese refineries can be employed to treat this raw material with every satisfaction.

WHAT about the quality of this toluene? Aromatic hydrocarbons from petroleum are extraordinarily pure, and when trinitrotoluene was made from petroleum derivatives the oil remained water-white for many months. The practical TNT manufacturers at Oldbury, England, have been quoted as stating that they much preferred to handle Borneo toluene-benzene than the materials obtained from gas works, even when the former might not be quite as pure.

But what about the reports we have had concerning the demolition of the oilfields in the Netherlands East Indies by the retreating Americans, British, and Dutch engineers? How can the Japanese put these fields back into production?

More than a year before Pearl Harbor, the Japanese were quite open in there admission of making preparations to take over the Borneo oilfields—by force, if necessary. Said Ichizo Ohmura, chief of the geological section of Nippon Petroleum Company: "Preparations have been made to wreck oil wells in Netherlands India in case of emergency. This is something we anticipated because it is very easy technically . . . but I must emphasize here that we have countermeasures to meet this situation."

These countermeasures comprised, primarily, the training of Japanese engineers in oilfield techniques under American experts both in Japan a number of years ago and more recently in the United States. Furthermore, as far back as the opening of the Nazi offensive in 1939, Japanese concerns started to acquire oilfield material of specifications particularly suited to drilling the comparatively shallow wells in the Netherlands East Indies.

During their lightning offensive, in the earlier attacks at least, the Japanese forces moved so rapidly as to seize control of some of the fields before adequate demolitions had been completed—for after announcing that certain points would not be defended, the Anglo-Dutch troops unexpectedly counterattacked at certain oilfields for a short time—presumably in an attempt to regain temporary control for a period long enough to complete demolition of the production facilities. This is in keeping with Japanese claims that they restored production to some areas within a few months of seizure (although they undoubtedly may have exaggerated the degree of their immediate success), and it is likely that Japan may now be benefiting to a considerable extent from the high-grade crudes of Borneo and other fields in the Netherlands East Indies.

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Ammunition Production

Establishment of a Field Office To Decentralize Administration

Col. T. C. Gerber*

IN July 1942, Maj. Gen. Levin H. Campbell, Jr., Chief of Ordnance, in line with his policy of decentralization, ordered the transfer of the administration of ammunition plants from Washington, D. C., to a focal point geographically central to the various ammunition-making plants which include, in addition to Government-owned and Government-operated plants, approximately sixty Government-owned, contractor-operated new Ordnance facilities producing ammunition† and allied raw materials under cost-plus-a-fixed-fee contracts. Ordnance Department Order No. 305, dated July 16, 1942, formally established an office for the administration of such plants. This order reads in part as follows:

"1. Effective August 1, 1942, there is established at St. Louis, Mo., an office designated as Field Director of Ammunition Plants.

"2. The Field Director of Ammunition Plants will be responsible, under the direction of the chief, Ammunition Branch, Industrial Division, Office of the Chief of Ordnance, for the coördination and direction of the activities of the Government-owned, contractor-operated facilities which are under the jurisdiction of the Ammunition Branch. Within policies set by the chief, Ammunition Branch, all instructions to and reports from these facilities will pass through the field director. Where instructions and reports go direct, copies will be furnished immediately to the field director. . . .

"4. The Field Director of Ammunition Plants is authorized to approve or direct, within policies stated by the Chief of Ordnance or the chief, Ammunition Branch, changes in structures, layouts, equipment, and processes found to be necessary for efficiency, safety, or law compliance."

The duties imposed upon the field director's office by order No. 305 were subsequently extended by Ammunition Branch Memorandum 48-42 to include supervision of ammunition loading and of facilities therefor at certain Government-owned, *Government-operated* plants.

St. Louis was chosen because of its rail facilities and central location with respect to the various plants under the jurisdiction of the field director. Office space in that city was obtained in the basement of the Scottish Rite Cathedral on Lindell Boulevard. Since the cathedral adjoins the St. Louis Ordnance District Office, joint utilization has been made of telephone and teletype service, photostatting and reproduction facilities, guards, etc. On August 1st, twenty-five Ordnance officers and thirty civilian employees, comprising, chiefly, the loading and assembly section of the Ammunition Branch and the remnants of the old Facilities Division, were transferred from Washington, D. C. Actual operation of the office began on August 5th, with Col. T. C. Gerber, Ord. Dept., as field director. The personnel was augmented as the work took shape, the present force comprising thirty-four Ordnance officers and ninety-eight civilians.

Of the new Ordnance facilities some manufacture propellent powder for the Army and Navy, including the various types of cannon and small-arms powder, diphenylamine, TNT, DNT, oleum, sellite, tetryl, toluol, anhydrous ammonia, ammonium nitrate, picric acid, ammonium picrate, lead azide, formaldehyde, hexamine, barium nitrate, and acetic acid; some load artillery primers, percussion elements, fuzes, boosters, detonators, bombs, and shells; and still others load bags with smokeless powder. The loading and assembly work embraces all the myriad types of Ordnance ammunition except small-arms ammunition.

A chart showing the principal divisions of the field director's office is shown on page 307. Subject to the chief of the Ammunition Branch, the field director has full executive and administrative control of the cost-plus-a-fixed-fee Government-owned, contractor-operated new Ordnance facilities of the Ammunition Branch and, further, has the production control of ammunition loading at all Government-owned facilities operated by the Government or by contractors.

THE Government-owned, contractor-operated new Ordnance facilities are unique when viewed from the standpoint of coöperation between the Government and industry. Since this country did not possess a munitions industry and since public funds were not available to the Ordnance Department to build large-scale munitions facilities, it was necessary in peace time to provide for such a noncommercial industry by planning the program from the ground up, with little but pilot plants as a guide.

Picatinny Arsenal prepared basic designs for loading plants, and the suboffice of the Ammunition Branch, located at Wilmington, Del., and headed by Maj. J. P. Harris (now Colonel Harris), in collaboration with the explosives and chemical industries prepared designs for the explosives and chemical works. Much of the design of the new Ordnance facilities was developed from these basic plans. Refinements, of course, were added, and, in the case of chemical plants, the designs of successful designers and operators in the chemical field were utilized.

Because the manufacture of munitions is fluctuating and uncertain and prospers only in time of war, private enterprise could not be expected to take the huge risks incident to the enormous capital expenditure necessary to set up a full-scale munitions industry as part of our national defense. The Act of July 2, 1940 (Public No. 703, Seventy-sixth Congress), together with various appropriation acts, enabled the War Department to contract with private concerns to build a munitions industry and operate it to make the complex products necessary to present-day warfare.

In July 1940, Lieutenant Colonel Campbell (now Major General, Chief of Ordnance), was made chief of the Facilities Division and had the responsibility of negotiating the new Ordnance facilities' cost-plus-a-fixed-fee contracts for

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†The term "ammunition" as used herein applies to all ammunition above caliber .50.

management or consultant services, for procuring production equipment and expediting delivery thereof, for training key personnel during the construction of the new Ordnance facilities, and for operating such facilities after they were built. The Quartermaster Corps and, later, the Corps of Engineers coöperated fully by constructing the facilities ahead of schedule through private contractors on sites purchased at the request of the Ordnance Department. As soon as a facility was completed and placed in operation, the particular operating branch charged with the procurement of the items which a particular establishment produced, took over the administration.

Since all the sites upon which these new facilities are located have been designated as military reservations, a commanding officer is assigned to each. He is in charge of the Government staff of auditors and inspectors and is present to assure protection of the Government's interests. While he has all the duties and responsibilities imposed upon commanding officers by Army Regulations, his chief function is to act for the contracting officer as his duly authorized representative. He is designated as the authorized representative of the contracting officer by name, and as such, as far as the contractor is concerned, he is the only recognized War Department representative at the site.

The Office of the Field Director of Ammunition Plants unifies and standardizes instructions to the contracting officer's representatives. This is necessary in the interests of efficiency and stability, as some contractors operate two or more facilities at different geographical locations under as many different contracting officer's representatives.

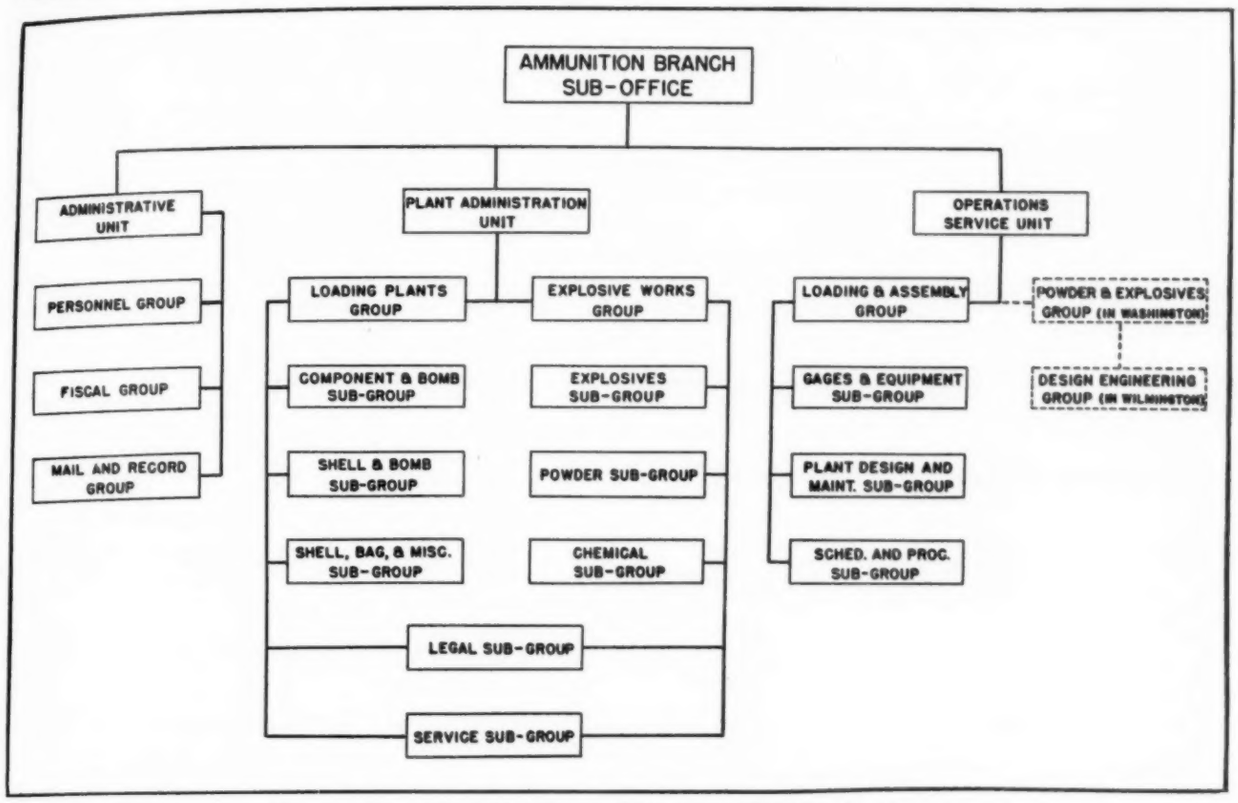
WHILE the outstanding objective is to produce Ordnance equipment, nevertheless, to preserve order every effort must be made to operate the new facilities in accordance with the terms of the applicable contract. Consequently, as shown on the organization chart, the field director's office includes a legal subgroup which renders advice on all legal questions, including the interpretation of contracts, laws, directives, etc., and which drafts all legal papers. Thus, a legal document which requires the contractors to comply with all laws —Federal, state, and local—and which allows for orderly administration is the basis for all activities at the facilities. The contractor may not legally engage in any business at the facility site not permitted by the contract; the contracting officer's representative may not legally order the contractor to perform work outside the scope of the contract. Hence the rights, duties, and obligations of each party are clearly defined and recorded.

Desired changes in the contracts, either change orders or supplements, are drafted by the legal subgroup after negotiation with the contractor and are submitted to the contracting officer for signature. All matters pertaining to fees and money payments are negotiated by one officer who has a business background. One officer is used in order to insure uniformity in theory and application thereof. This officer is attached to the legal subgroup to assure the close contact desired. It is apparent, with the numerous contractors and contracting officer's representatives and with the number of contracts which vary to some extent, that there are, and always will be, many questions concerning the interpretation of the contracts. The original contracts, however, were drawn carefully and were made purposely broad, with the result that no serious controversies have arisen between the Government and the contractors. The legal subgroup acts as the legal adviser not only to the field director but to the contracting officer's representatives as well.

The administrative unit performs the usual office-management functions and, in addition, under the personnel group maintains records of the military personnel under the field director's jurisdiction (which includes the military personnel assigned to the new Ordnance facilities) and recommends to the Chief of Ordnance allotments, transfers, etc., in keeping with the officer-personnel requirements. The number of officers assigned to the facilities is being reduced rapidly because the Government procedures have been well established, work is going along smoothly, and production is satisfactory. The total number of officers of the Ordnance Department under the jurisdiction of the field director has been reduced over the past 5 months from 534 to 436 and probably will approximate 300 in the near future.

The plant-administration unit exercises administrative control over the various facilities, establishes policies, and aids individual facilities in solving the problems that arise. The facilities are grouped, for administrative purposes, according to their products. One group, entitled the loading-plants group, administratively supervises all shell-, bag-, and component-loading facilities, while the other, named the explosives-works group, performs like functions with respect to all powder-, explosives-, and chemical-manufacturing establishments. Each group is headed by an individual selected from industry and designated deputy field director who coördinates the group efforts. To each deputy is assigned a small group of officers as assistants for the administration of small groups of similar plants. Each deputy, being assigned a group of similar facilities, becomes familiar with their peculiar problems and by close contact with his assistants is enabled to recommend policies and arrive at decisions of maximum application to the various establishments. These assistants are the administrative "trouble shooters" and form the administrative inspectorate. Their instructions are issued to the contracting officer's representatives. They also maintain close contact with the contractors in order that any administrative matters impeding the contractors' efforts may be rectified.

A VERY important feature of the work of the plant-administration unit is the coördination of, and close contact with, the Contractors' Industry Integrating Committees. To organize these committees, the facilities were divided into nine groups according to type of product or operation (smokeless powder, TNT, bomb loading, shell loading, etc.). Each group has an industry integrating committee consisting of the manager of each plant within that group. The following committees are operating: bomb-loading, shell-loading, shell- and bomb-loading, component-loading, bag-loading, powder, H.E., and chemical. Brig. Gen. R. E. Hardy, as chief of the Ammunition Branch, is *ex officio* chairman of these committees. The integrating committees coördinate their study of all phases of contractor performance, including costs, process standardization, etc., in order to achieve optimum efficiency and to determine basic causes for performance differences. The committees furnish the chief of the Ammunition Branch and the field director with information on costs, yields, process technique, personnel requirements, housing and transportation problems, and all the various management phases. In addition, these committees appoint subcommittees to study specific problems and to recommend uniform procedure for such matters as cost accounts, pro-



ORGANIZATION OF THE ORDNANCE AMMUNITION BRANCH SUB-OFFICE

cess technique, guard and protection requirements, transportation-equipment requirements, stores, receiving and shipping procedures, etc.

The service subgroup accumulates and disseminates information on industrial relations and other administrative statistical matters for use of the higher echelons in the War Department and for the facilities themselves.

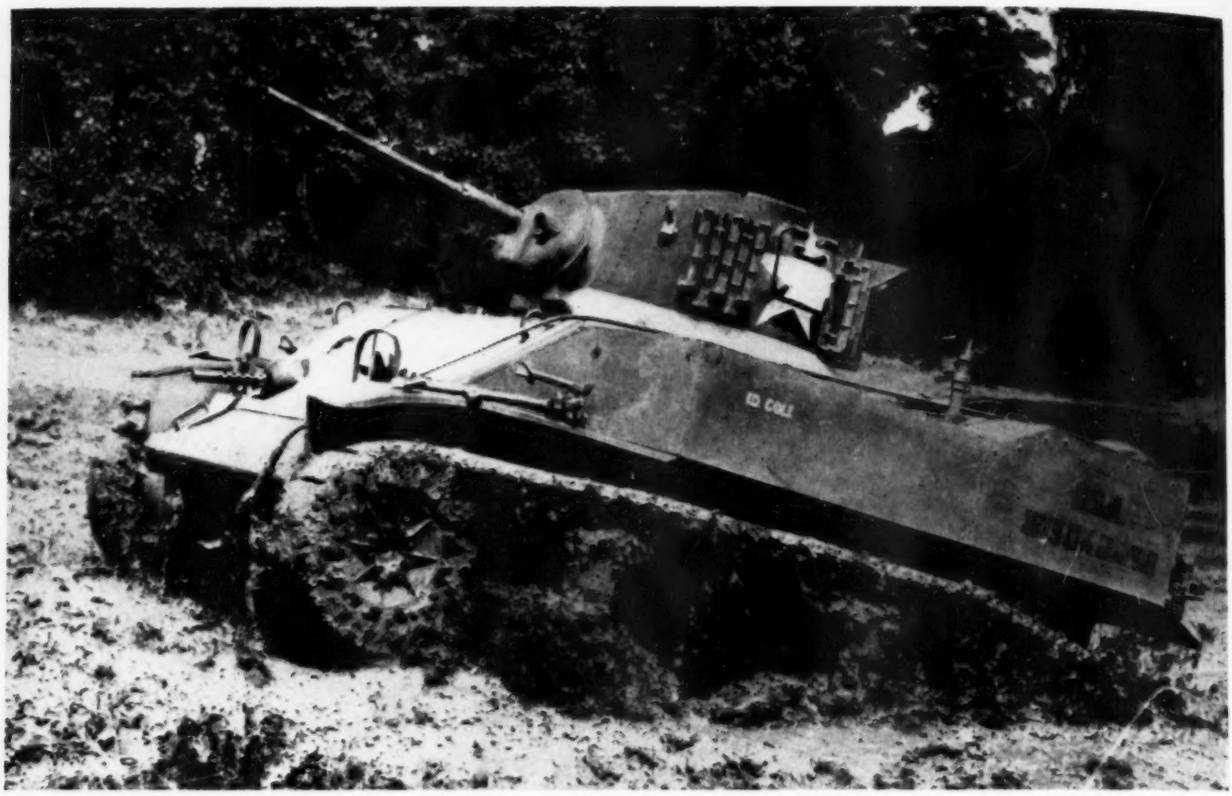
The operations-service unit is chiefly concerned, at present, with the loading plants. As its name implies, this unit does not operate but serves the contractor-operator in every technical feature of loading. In order to maintain quality control and to instruct plant personnel in the working of new or changed items or in new techniques, this group maintains a small corps of loading specialists. These specialists, together with contractor specialists, form subcommittees for the prompt solution of any existing or anticipated problems. This unit also prepares detailed schedules for these plants and supervises performance of loading and renovation schedules. The task of scheduling operations at the loading plants was transferred from Washington to St. Louis on November 17, 1942. The operations-service unit is also concerned with the supply and standardization of loading equipment and gages and with all matters of plant design and maintenance.

The approximately sixty new Ordnance facilities under the control of the field director are geographically located in an area extending from Massachusetts to Texas and from Wisconsin to Alabama. On December 1, 1942, most of these facilities were fully completed and operating; some, almost completed, were partially operating; and the balance will be completed soon. The total construction costs of all these plants, including equipment but excluding land, will be approximately $2,200,000,000; the total annual operating cost is estimated at $1,700,000,000; the total number of contractors' employees engaged in operation on December 1st, was 202,000; and it is expected that, when all plants are operating, this number will reach 260,000. A considerable portion of these employees are women, and the men now are being rapidly replaced by women in order to conserve man power. In December, the Ordnance supervisory staff (including the field director's office and all military and civilian personnel assigned to the facilities) consisted of 436 officers and 9,900 civil-service employees, a great and increasing proportion of whom are women. It is expected that the Ordnance supervisory staff will be further reduced when all plants are operating fully and when procedures have been more firmly established.

Substantial economies have been effected in Government activities by eliminating duplication by Ordnance personnel of work wherever found to be satisfactorily done by the contractor and by simplifying accounting through elimination of records no longer necessary under existing reporting requirements. Economies were further effected by restriction of inspection activities to tests of the acceptance type, supported by a continuous review and by selective checks of the routine inspections.

In general, the Field Director of Ammunition Plants has the mission of analyzing and coördinating the activities of the facilities under his jurisdiction, permitting each facility to profit by the experience of others. This analysis and coördination already have ended many duplications of functions and unnecessary reporting and have led to the abolition of unnecessary activities being carried on by the contractors or the Ordnance Department. As the information collected increases and the organization of the suboffice develops, it is expected that its operations will be reflected in greater, more efficient, and more economical production.

The Army's New Light Tank, M5



This new combat vehicle has a larger hull and turret than the previous model, giving more room and greater protection to crew and mechanism, as will be noted by comparison with the older tank shown on page 279. The M5 is of welded instead of riveted construction and has many other innovations. It is armed with machine guns and a high-velocity cannon.

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MARCH-APRIL, 1943

Month by Month

Tanks versus Self-Propelled Artillery.—While President Roosevelt, Prime Minister Churchill, and the American and British Combined Chiefs of Staff were conferring at the historic Casablanca meeting in mid-January, British General Montgomery and the Eighth Army were pursuing Rommel's fleeing forces through Tripolitania and into Tunisia, climaxing a record-breaking drive from El Alamein in Egypt. At least a substantial part of the German debacle is due to the skillful use of superior American mechanized equipment, such as the M4 General Sherman tank with its cast-steel hull and the M7 armored self-propelled 105-mm. howitzer tank destroyer. An entire artillery regiment of the Eighth Army was equipped with this latter weapon, and Under Secretary of War Patterson reports (p. 317) that at El Alamein "it performed splendidly, suffered no technical trouble, and was responsible for the low rate of British casualties on the offensive. The M7 is heavily protected with armor—not one of them was knocked out in that battle by Nazi artillery or Nazi bombs."

This is indeed a remarkable record, and whether it marks the passing of the tank as prime offensive armor and the rise of the armored self-propelled gun is a question that coming events will no doubt decide. The Greenville (S. C.) *News* makes the following interesting editorial comment on the problem:

> World War II brought the tank into prominence as one of the most formidable weapons of mechanized warfare. But question is now being raised as to whether, even before this war ends, the tank as now built may become of diminished importance, perhaps even become obsolescent. President Roosevelt's statement in his message to Congress about revision of the tank-production schedule for "good and sufficient reasons," has provoked new speculation on the subject. Mr. Roosevelt, naturally, did not go into detail but said that as a result of "hard experience," a portion of our tank-producing capacity has been diverted to a stepped-up production of "new, deadly field weapons, especially self-propelled artillery." Some of the experts are commenting that the fighting in Africa has demonstrated that no matter how formidable an armored vehicle may be it can be stopped by a mobile gun of superior power.
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> The tank is a sort of modern mechanized "cavalry," and it is also a form of mobile artillery. The fact that a tank can be stopped by heavy gunfire doesn't necessarily mean that its usefulness is diminished as a means of rapid troop movement in battle, for just about anything can be "stopped" if heavy enough fire can be brought to bear upon it, and that is the chance that any equipment or fighting unit must take when it goes into a fight. But there seems to be a process of evolution of the tank's function as mobile, self-propelled artillery. Heavier and more deadly mobile field artillery might be regarded as a specialized weapon to fulfill more effectively this function of the tank. The guns are mounted on a tank chassis and the device would appear to be, in fact, a new weapon brought into being by this war—the "tank destroyer." While one ventures the guess that the tank will not be replaced or become "obsolete," it may well be that we are seeing a process of separation, in a certain degree, of the two functions of the tank, and that there may be changes to enable the tanks themselves to serve more effectively as armored vehicles for troop advance.

Whatever may be the final result, it seems obvious that self-propelled artillery is due to play an increasingly important rôle in modern warfare. Such a weapon, however, is not new to the Ordnance Department. Pilot models of self-propelled guns were planned as early as 1916 and development continued through the years that followed, despite meager funds and lack of encouragement. (A pictorial account of this development is shown on pages 293 to 300.) If the self-propelled gun has finally found a place in the military sun, the Ordnance Department is gratified—but not surprised.

Ordnance Plant Conversion.—A conversion program to make the Army's excess Ordnance facilities available for other types of war production is being pushed by officials of the War Production Board and the Services of Supply. One of the reasons for the decision to curtail output of heavy ordnance items is to make greater supplies of critical raw materials available for a sharply increased plane and ship program.

Every war plant where production was restricted or production stopped is being studied carefully to determine its possible use in the revised schedules, with the expectation that few, if any, will remain closed indefinitely.

It has been said that the shift in emphasis from ordnance to aircraft and ships was adopted by the Army in November, partly because a reserve of such items as tanks, trucks, some categories of heavy guns and small-arms ammunition had been accumulated, and partly because the production rate was running ahead of the capacity to make deliveries to the combat zones.

A Report on Lend-Lease.—The United States has now outstripped the war production rate of every other allied nation and supplied nearly $8,253,000,000 worth of Lend-Lease goods and services to other countries from March 11, 1941, to December 31, 1942, Lend-Lease Administrator Edward R. Stettinius, Jr., stated in his report to Congress.

The furnishing of Lend-Lease aid declined from a peak of $915,000,000 in October to $810,000,000 in November and $757,000,000 in December, the report disclosed. But the total for those three months was twice the total for all of 1941, and the full year's total in 1942 of $7,009,000,000 was more than five times that of 1941.

One tank and combat plane out of every three built in this country in 1942 was shipped to our allies, but this took account not only of Lend-Lease but of outright foreign purchases from us.

The following table shows, in thousands of dollars, United States Lend-Lease aid, in military items and industrial materials, to the United Kingdom, British dominions and territories, Egypt, and Soviet Russia from March 1941 through December 1942.

Type of Aid	*United Kingdom*	*British Dominions, Territories and Egypt*	*U.S.S.R.*
MILITARY ITEMS			
Ordnance	147,534	130,307	39,639
Ammunition	196,288	303,172	148,288
Aircraft and parts	344,188	483,188	318,969
Tanks and parts	60,298	255,400	210,305
Motor vehicles	55,465	127,588	139,136
Watercraft and parts	285,112	90,035	15,549
Miscellaneous	82,773	30,926	39,816
Total	1,171,658	1,420,616	911,702
INDUSTRIAL MATERIALS			
Machinery	141,369	74,792	62,001
Metals	251,673	131,390	113,909
Petroleum products	252,862	62,427	14,806
Miscellaneous	269,676	100,758	56,224
Total	915,580	369,367	246,940

Not Great Britain but Russia apparently has been the greatest beneficiary of Lend-Lease. Up to January 1, 1943, the United States had shipped to the Soviet Union under Lend-Lease more than 3,200 tanks, almost 2,600 planes, and 81,000 trucks, jeeps, and other military motor vehicles, the report stated. This is more than we have sent to the United Kingdom or any other military theater under Lend-Lease since the beginning of the Lend-Lease program in March, 1941, although Lend-Lease aid to Russia did not begin until October 1941—eight months later.

Automotive Maintenance.—The increasing use of motorized equipment in today's warfare is making it more and more evident that a truck or a tank that breaks down due to lack of proper care is the same as a truck or tank disabled by the enemy. Likewise, a vehicle that can be kept in operation makes it unnecessary to manufacture a new one and ship it perhaps thousands of miles to replace one out of commission.

Now that Ordnance is responsible for all the Army's automotive equipment, preventive maintenance should be more than a beautiful theory to every one in the Department—it should mean a sensible way to save time, materials, money, and priceless equipment. ARMY ORDNANCE, in its desire to foster the preventive-maintenance habit, is happy to be able to publish General Kirk's present authoritative series of articles on the subject (p. 322), and General Kutz's interesting account of "Joe Dope the cartoon commando" (p. 320). Finally, to emphasize the importance of preventive-maintenance, we are privileged to reprint the following message of Secretary of War Henry L. Stimson to the men and women of the U. S. Army:

> Maintenance of trucks, tanks, and all the vehicles of war at a high standard of performance is as important to the success of the Army as the physical fitness of its personnel. The Army supervises programs to insure the continuing health of its men and women. Maintenance of the same degree of perfection in vehicles depends squarely upon their crews.
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> Whether you are in a training camp in the United States or in the forward line of a combat area, "readiness for battle" must be the standard by which you judge the condition of this equipment which has been entrusted to your care. The whole long chain of production and supply—from assembly at the factory to delivery on a distant shore—is severed if a vehicle's high perfection is permitted to deteriorate through lack of responsible care.
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> I call on every man and woman serving with the Army of the United States to unite in a campaign of preventive maintenance designed to abolish the menace of mechanical failures and to get the most from the fine machines which industry has provided. This is your responsibility. I depend upon you to see it through.
>
> HENRY L. STIMSON

Matériel Standardization.—In a move to standardize further the specifications and requirements for numerous items of war matériel used by the Army and Navy, the War and Navy Departments have created the Joint Army-Navy Committee on Specifications. The purpose of this step is to facilitate and increase the flow of war materials from the factories of the United States by reducing all unnecessarily different specifications and requirements. Coöperation between the two services has standardized many items from clothing to arms.

This new committee will make an effort to further standardize specifications over a wide range. The committee will establish joint specifications which will be known as "JAN" specifications. These are to be used for items or materials similar in technical requirements and peculiar to the War and Navy Departments. The "JAN" specifications will not cover items already covered by Federal specifications.

The Critical Period of World History

An Editorial

AS THE Constitutional Convention, which met at Philadelphia in 1787, drew to a close and the present Constitution of the United States, the apotheosis of modern democracy, was about to be given the substance which time has so truly shown its form deserved, the venerable Franklin drew attention to a half-sun, painted back of the presiding officer, and said: "I have, often and often, in the course of the session and the vicissitudes of my hopes and fears as to its issue, looked at that behind the president, without being able to tell whether it was rising or setting; but now at length I have the happiness to know that it is a rising and not a setting sun."

Franklin's misgivings during the course of the Convention as to its probable outcome had ample foundation in what was then recent history. The time between the surrender at Yorktown, October 19, 1781, and the final ratification of the Constitution by New Hampshire on June 21, 1788, has been called by John Fiske the "critical period" of American history. The Declaration of Independence had set forth the theory of democracy—the doctrine that the state exists for the individual and not the individual for the state—in ringing words. The war won, it then remained to be proved that an effective democratic government could be administered by a free people no longer supported by the unifying effect of war against a common enemy. The Articles of Confederation soon showed themselves unworkable. Interstate, intersectional, and other group interests sprang into the arena. The central government lacked power to enforce its will. The success of democracy hung in the balance. But the adoption of the Constitution resolved the matter, and democracy was saved.

Recent events indicate that the democracy then saved in America is not going to be lost, in the present global war, to the Moloch of a totalitarianism either of the extreme right or of the extreme left. What this loss could mean is evident if we conceive for a moment what the situation would be in continental Europe if there were no outside powers to rescue its subjugated millions. What chance would the French, the Norwegians, the Poles, the Czechs, the Jews, and the other captive peoples have to escape the ruthless sadism of Hitler and his fellow barbarians? With utter disregard of all dictates of humanity, Hitler could complete his work of wholesale slaughter of the "inferior," of forced mass migrations, of human breeding as a farmer breeds stock until the entire area contained only those whose "quality" conformed to his perverted standards. No longer can embattled farmers fire shots heard 'round the world. Their guns are not good enough. Lacking tanks, cannon, and all means of aërial combat, they can only submit or die. Democracy once destroyed might not rise again. It is up to the free nations of the world to preserve their heritage for future generations.

It is not too early to begin to think of the new critical period which will arise in world history when hostilities cease in World War II. There will be many circumstances analogous to those that confronted the United States after the Revolution but also many and vital differences. Then, the people concerned were reasonably homogeneous, not seriously concerned with religious differences, nor embarrassed by language difficulties. Today, all this has changed.

The world will have to feel its way forward into the unknown just as did the United States on the prior occasion. Statesmen will have to resolve the problems of unbalanced forces caused by the spread of science and technology, the ease of communications and transportation, differences in race, and many other factors which will cause conflicts of opinion among the chancelleries of the world. Any practicable world federation will have to include the peoples who are now our enemies as well as those who are our friends. Democracy, saved by the United Nations, must not be lost by a failure in statecraft in the new crisis of peace.

What, it may be asked, has this to do with the membership of the Army Ordnance Association? Why should the society interest itself with questions that are primarily for statesmen to consider? Should not the shoemaker stick to his last and the Army Ordnance Association confine its attention and energies to coöperating with the Government in its efforts to get armament to our soldiers on the battle fronts?

THE answer is not difficult. Tomorrow's action will be dependent upon today's thought, and it is a fact—that should be so clear that he who runs can read, whether in a policeless Boston or an unmobilized Holland—that government, when challenged, is only effective if it has back of it the physical means of enforcing its authority. Therefore it is imperative that these means shall not be lacking as our nation faces the unknown future. America gave a thorough trial to the assumption that World War I had ended war. The results came dangerously close to being fatal to democracy. That mistake must not be made again.

An old adage runs: "Trust in God and keep your powder dry." This was born in an earlier age when armament was simple and the existence of the powder could be taken for granted. In this complex age of rapid movement, the old adage should be streamlined to conform with the trend of the times. It is better shortened: "Trust in God and keep your powder." The task of the Army Ordnance Association is clearly to assist our Government in "keeping its powder" in the sense that the United States must be, not a nation in arms, but a nation whose capacity for taking up arms to meet any foreseeable contingency shall be so great as to make such a contingency unlikely.

The field of the Association is, primarily, American industry. The art of making ordnance must be kept alive by our arsenals, by educational orders, and by other means. Scientific and technological progress must be applied promptly to the development and improvement of armament. Raw-material requirements and resources must be investigated—provision must be made for our needs for critical and strategic raw materials or for substitutes for them when such substitutes can be used. Trained personnel must be ready for the repair and maintenance of armament in the field. In these and similar spheres, the membership of the Association can render invaluable service to our Government in its task of building for permanent preparedness.

Let us, at all costs and with all efforts, maintain adequate armament preparedness during the peace that follows World War II. Let us make World War III impossible. Let us keep our powder!

Association Affairs

NEW POST ESTABLISHED IN DETROIT

THE twenty-first local chapter of the Army Ordnance Association was established on December 12, 1942, when fifty civic leaders from the Detroit area met, at the invitation of Brig. Gen. A. B. Quinton, Jr., chief of the Detroit Ordnance District, to organize a Detroit Post of the Army Ordnance Association. All those present had been members of the Association for some time but had not been organized as a local Post.

The principal business of the inaugural meeting was the election of officers for the coming year. Col. Herbert W. Alden, director of engineering of the Timken-Detroit Axle Company was elected president. Colonel Alden has long been identified with the automotive industry in the United States and has done outstanding work in the design and production of military equipment. He was a member of the organizing committee which founded the Army Ordnance Association in 1919. In tribute to his services to the national defense, the Association presented Colonel Alden with its Frank A. Scott Gold Medal for Meritorious Service to Industrial Preparedness at the Association's Twenty-second Annual Meeting in Detroit, October 9, 1941.

Edward T. Gushée, assistant to the president of the Detroit Edison Company and a member of the advisory board of the Detroit Ordnance District, was elected first vice-president of the Post. George D. Bailey, a partner of the firm of Ernst & Ernst, was named second vice-president. Mr. Bailey is likewise a member of the Detroit District advisory board and is president of the Detroit Bureau of Governmental Research. Capt. John W. Paynter, assistant executive officer of the Detroit Ordnance District, was elected secretary-treasurer of the new Post.

The following directors were also elected: Charles T. Bush, vice-president of the Industrial National Bank and president of the Chas. A. Strelinger Company; Edsel B. Ford, president and treasurer of Ford Motor Company; George M. Holley, chairman of the board, Holley Carburetor Company; C. H. Hodges, Jr., president, Detroit Lubricator Company; O. E. Hunt, vice-president on special assignment and executive assistant to the president, General Motors Corporation; Phil Huber, president and general manager, Ex-Cell-O Corporation; K. T. Keller, president, Chrysler Corporation; William G. Lerchen, partner, Watling Lerchen Company; C. J. Reese, president of Consolidated Motors Corporation and of Continental Aviation & Engineering Corporation; S. T. Stackpole, freight traffic manager, Pennsylvania Railroad.

In a brief address, General Quinton said: "Detroit, the center of the automotive industry and one of the greatest armament-producing districts of the country, has several hundred members of the Army Ordnance Association, who, through the Detroit Post, will be welded into a cohesive group, the better to serve their country in war and in peace."

CINCINNATI POST

THE annual election of officers and directors of the Cincinnati Post was held last December and the new officials were installed at a meeting on January 12, 1943. The new president of the Post is Harvey C. Knowles, vice-president of Proctor & Gamble Company. He replaces August H. Tuechter, who was elected to represent the Cincinnati Post as a national director of the Association. Mr. Tuechter is president of the Cincinnati Bickford Tool Company.

The other officers are: vice-president, Richard E. LeBlond, vice-president of R. K. LeBlond Machine Tool Company; secretary, Col. Fred A. McMahon, chief of the Cincinnati Ordnance District; treasurer, Maj. E. W. Harrison, Ord. Dept.

The following directors were elected to serve during 1943-1944: Col. A. W. Herrington, chairman of the board, Marmon-Herrington Company; Col. A. H. Pugh, president, A. H. Pugh Printing Company; E. A. Muller, president, King Machine Tool Company; S. E. Steinbeck, manager of the Washington office of Tube Turns, Inc.; C. H. Kindl, vice-president, National Cash Register Company. The following are also directors of the Post, having been elected to serve during 1942-1943: Frederick V. Geier, president, Cincinnati Milling Machine Company; and Maj. A. F. Hubbard, vice-president, Kilgore Manufacturing Company.

UNIVERSITY OF MICHIGAN POST

THE University of Michigan Post at Ann Arbor, Mich., recently held its annual election of officers at which the following were named to serve during the coming year: George Brundrett, president; Leslie Parr, vice-president; James Carmichael, recording secretary-treasurer; Arthur S. Wiseman, Jr., corresponding secretary. The Post has been actively engaged in a campaign for additional members and has been sponsoring various speakers at its meetings. Recently, Herbert Howerth, of the Alemite Corporation, who has been a civilian observer with troops on southern maneuvers, addressed the Post on proper lubrication in the maintenance of ordnance matériel.

THE PRESIDENT HONORS "PRODUCTION SOLDIERS"

AMERICA'S "production soldiers," who are showing almost unbelievable ingenuity in working out ways to beat the Axis, received new recognition when President Roosevelt personally bestowed honors on ten men at the White House on December 10th for their suggestions for increasing war production. In the first ceremony of this kind in the country's history, six workers, chosen from the war industries in coöperation with local labor-management committees, received citations of individual production merit signed by Donald M. Nelson, war-production chief. Four additional workers received certificate awards.

The result is expected to be a further stimulant to employee participation in factory suggestion-box systems and still wider recognition of the fact that practical ideas of production men, dropped into suggestion boxes by the thousands each week, are actually playing a vital part in increasing production.

Typical of the production achievements to be honored at the White House is that of Walter P. Hill, Detroit development engineer for the Wolverine Tube Division of Calumet and Hecla Consolidated Copper Company and a member of the Army Ordnance Association. Mr. Hill devised a notable improvement in methods of fabricating a small primer tube used in the firing mechanism of millions of large shells produced in this country. He augmented his work at the plant with long hours spent in a fully equipped machine shop in the basement of his home and developed a process that effects remarkable savings in critical materials as well as in man-hours and machine time. One operation now does work that previously took six separate production operations. Since devising this improvement, Mr. Hill has been busy, with the coöperation of his employer, in working with Ordnance offices from coast to coast, assisting other plants to make full use of the new method, and multiplying the importance of the production increase accomplished.

Others honored by the President were: Joseph H. Kautsky, Link-Belt Company, Indianapolis, Ind.; Clinton R. Hanna, Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.; Edwin Curtiss Tracy, R.C.A. Manufacturing Company, Camden, N. J.; Madison E. Butler, Stromberg-Carlson Telephone Manufacturing Company, Rochester, N. Y.; and James A. Merrill, Goodyear Tire & Rubber Company, Akron, Ohio. Certificate awards were presented at the same time to:

George Smolarek, Packard Motor Car Company, Detroit, Mich.; Daniel W. Mallett, Borg-Warner Corporation, Rockford, Ill.; Herbert R. James, National Tube Company, McKeesport, Pa.; and Stanley Crawford, R.C.A. Manufacturing Company, Camden, N. J.

Oklahoma Ordnance Works

LIEUT. COL. L. E. ANGLE is the new commanding officer of the Oklahoma Ordnance Works, having succeeded Lieut. Col. S. R. Kimble, who has assumed a new post at the Ogden Arsenal at Ogden, Utah.

Colonel Kimble, who has seen forty-one years of Army service in the Cavalry, Coast Artillery, and Ordnance Department, before leaving addressed a farewell message to the employees at Oklahoma.

"In relinquishing command of the Oklahoma Ordnance Works," Colonel Kimble said, "I take this opportunity to voice as nearly as I am able, a message to each and every man and woman who has aided in building, organizing, and operating this great plant.

"A little over a year ago, a mere handful of us arrived on the scene and on what were formerly Oklahoma grass lands, fields, and woods, began the work which carried on through the ensuing months and resulted in the accomplishment of the task set before us. Today the hum of the activities you see about you is the monument to that effort.

"Our task was not easy, our troubles many, living conditions poor, and transportation inadequate; yet, in spite of all, we have won out. Not only have we built and are operating a great plant, but we have also built a great organization—one founded on hard work, loyalty, and a desire to win."

Colonel Angle, the new commanding officer, came to the Oklahoma Ordnance Works from the Hoosier Ordnance Plant where he was executive officer. His experience in ordnance work dates back to the days immediately after World War I when he was in command of the Tullyton Arsenal until December 1920. He served as a captain during that war, having entered as a private, and remained in the Army after the Armistice.

James F. Oates, Jr., Joins Ordnance Legal Branch

JAMES F. OATES, JR., prominent Chicago attorney who for the past ten months has been a member of the advisory board of the Chicago Ordnance District, has been appointed chief of the purchase policy section of the Legal Branch of the Ordnance Department in Washington. Mr. Oates will devote his attention to the legal aspects of purchasing procedure and methods within the Ordnance Department and will also assist in determining Ordnance policies regarding contract renegotiation. Mr. Oates entered the Chicago Ordnance District during a period marked by an unusually rapid expansion due to the Army's urgent war needs. While serving with the district he supervised four important divisions: general office, traffic and property, contract service, and the price-adjustment section. A biographical sketch of Mr. Oates was published in the July-August issue of ARMY ORDNANCE (Vol. XXIII, No. 133, p. 107).

Ordnance School Graduation

TWO hundred and twenty-five newly commissioned second lieutenants in the Ordnance Department heard a stirring address by Lieut. Col. John D. Billingsley, commandant of the Ordnance School of the Aberdeen Proving Ground, Md., in which he urged them to go out into their new assignments with a firm resolve to dedicate their military careers to "the complete eradication of the spirit of aggression, oppression, and interference with national and individual rights to pursue the way of life which we have become accustomed to look upon as the American way."

"I would like to consider this graduating class as the 'Pearl Harbor Class' of the Ordnance Officer Candidate School in view of the nearness of your graduation to the anniversary of that attack," Colonel Billingsley said.

"You, as Ordnance men, will find little glamor or romance. This work is taken for granted by those you serve. They are so accustomed to receiving such service that it is hardly ever discussed except when adverse conditions reduce its effectiveness. The Ordnance Department has thus enjoyed an enviable reputation in the Army for many years. This is largely due to its service to troops. Upon you, then, and thousands more like you, will come to rest the future reputation of the Department.

"When the bombardier joins with the pilot in acclaiming their exploits aloft, he will naturally overlook many factors that made their accomplishment possible. You, however, who perhaps hung the torpedo in his plane, may well know that the destructiveness of the blows they dealt is in no small part due to the thoroughness with which you made a hundred-odd settings and adjustments. We must learn to serve the cause quietly and sincerely and let the accomplishments of the entire effort be our reward for tasks well done.

"Remember this: The truly great leader overcomes all difficulties—and campaigns and battles are nothing but a long series of difficulties to be overcome. Lack of equipment, lack of food, lack of this or that, are only excuses. The real leader displays his qualifications by his triumphs over adversities, however great they may be."

Ordnance Soldiers Receive Decorations

FIFTEEN officers and enlisted men of the Ordnance Department recently were awarded the Purple Heart decoration for wounds received in service in actions in the Southwest Pacific. All but one of these men were wounded after volunteering as members of gun crews on vessels carrying supplies for the relief of forces being besieged by the Japanese in the Philippines. These were cited for "singularly meritorious acts of essential service near Bathurst Island, Northern Territory, Australia, on February 19 and 20, 1942." In addition to their voluntary service under fire, the citations accompanying the awards also list specific acts of courage for each man.

2nd Lieut. Joseph F. Kane "displayed courage and fortitude that was an inspiration to all." Lieutenant Kane later succumbed from his injuries.

1st Sgt. Chancy M. Hills "displayed courage and devotion to duty by remaining at his post through heavy enemy fire until he was seriously wounded."

Tech. Sgt. Otto T. May "suffered shrapnel wounds in the course of this mission but helped other wounded men before securing first aid for himself, thereby displaying courage and devotion to duty."

Staff Sgt. Anthony B. Cumm "throughout severe enemy attacks displayed calm courage and devotion to duty and gave aid to others who were wounded."

Staff Sgt. Gerald H. Watson "showed high courage and devotion to duty by remaining at his gun until it was disabled by enemy action, whereupon he gave first aid to his wounded comrades."

Sgt. John D. Bell "remained at his post, displaying courage and devotion to duty in the face of heavy enemy fire."

Corp. Harold Kissell "manned his gun until it was put out of action by enemy fire. Then he helped extinguish fires caused by enemy bombs and aided wounded comrades to reach a place of safety."

Corp. Marcellus B. Olmsted "carried out his duties in a courageous manner although constantly endangered by shell fragments and enemy strafing attacks."

Pvt. Bethel L. Kniphfer "saved the life of an injured enlisted man, although suffering burns himself. Throughout heavy enemy action he displayed courage and valor."

Pvt. Stanley R. Foster "manned his gun until it was put out of commission by enemy action. He then gave aid to others who were wounded, although constantly exposing himself to danger from shells and strafing attacks."

Pvt. Ruby Prater "courageously exposed himself to enemy fire, in the course of which he was seriously wounded and burned by shrapnel."

Pvt. John A. Mayberry "showed fortitude in the face of heavy enemy fire. He gave first aid to the wounded and encouraged them while helping them to safety."

Pvt. William S. Riley "manned his gun until wounded by shrapnel from the enemy."

Pvt. Clarence M. Poulsen "was wounded by a bomb explosion. Before receiving first aid he helped others who were wounded."

Pvt. William I. Carothers was decorated for wounds received in action at Nichols Field, Philippine Islands, on December 10, 1941.

In addition to these Ordnance soldiers who received the Purple Heart, 1st Lieut. John E. Harbert, Ord. Dept., recently was awarded the Distinguished Service Cross for extraordinary heroism in action near Cape Sudest, New Guinea, on November 16, 1942. When enemy airplanes attacked and set fire to a small ship, Lieutenant Harbert organized a party of men to pull to shore a barge loaded with men and ammunition. "Throughout repeated strafing by hostile planes, he refused to take cover and continued his efforts. When flaming debris from explosions of munitions aboard the ship fell on the barge, he remained aboard and personally assisted in throwing the fragments overboard and in extinguishing the flames."

These men and their heroic deeds are a source of pride and inspiration to all members of the Ordnance Department. They are following in the tradition long established by Ordnance soldiers of the past who were willing to risk their lives to "keep 'em firing."

General Minton Heads New S.O.S. Unit

Brig. Gen. Hugh C. Minton, a charter member of the Army Ordnance Association, has recently been made director of the new Resources and Production Division of the Services of Supply, under the Assistant Chief of Staff for Matériel, Maj. Gen. Lucius D. Clay. The new division was formed by merging the Resources Division and the Production Division of S.O.S. into one organization. It will report to General Clay through the recently established Office of Production Scheduling, headed by S. E. Skinner, of Detroit, Mich.

Serving as deputy directors under General Minton will be Brig. Gen. Theron D. Weaver and Howard Bruce, of Baltimore, Md. General Weaver will have supervision over those functions and responsibilities formerly under the jurisdiction of the Resources Division, while Mr. Bruce, in general, will have supervision over those functions formerly under the Production Division. Col. Harold E. Eastwood, G. S. C., has been appointed as executive officer to the new division.

General Armstrong Commands Training Center

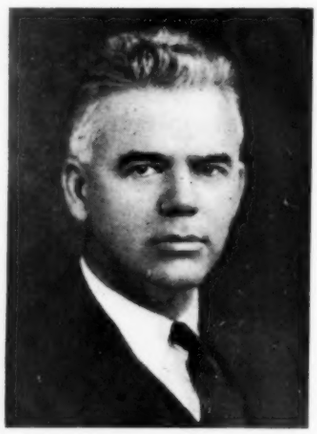
Brig. Gen. Donald Armstrong, formerly chief of the Tank-Automotive Center in Detroit, has been appointed commanding general of the Ordnance Replacement Training Center, Aberdeen Proving Ground, Md., and assumed his new post on January 18th.

General Armstrong has been a member of the Army Ordnance Association since 1924 and was secretary of the Chicago Post before going to Detroit. He replaces Col. George W. Outland, former Center commander, who is now Ordnance officer for the Desert Training Center, Services of Supply, at Pomona, Calif.

Necrology

Col. Paul Weeks, for many years associated with the Holt Manufacturing Company and Caterpillar Tractor Company died at his home in Kenwood, Md., on December 20th, after an illness of several months.

After completing his engineering training at the University of Nebraska and the Massachusetts Institute of Technology, Colonel Weeks entered the employ of the Baldwin Locomotive Works, in whose interests he traveled extensively in South America. Returning to this country, he made his home in Los Angeles, Calif., and engaged in copper-mining activities in Arizona. At that time he also became interested in tractors and designed and built a tractor which, however, was not put into commercial production. In 1915 he was engaged by Pliny E. Holt to assist him in the engineering activities of the Holt Manufacturing Company. With the entry of the U. S. into World War I, Mr. Weeks entered military service as an officer in the Ordnance Department and was assigned to engineering duties with the Tank and Tractor Division at the Aberdeen Proving Ground and in Washington, D. C. By the Armistice, he had been advanced to the rank of colonel.



Col. Paul Weeks

Late in the 1920's, Colonel Weeks joined the Caterpillar Tractor Company as general service manager, continuing in that capacity in Peoria, Ill., until several years ago when he was transferred to the company's offices in Washington, D. C.

Funeral services were held December 22nd, in the chapel at Fort Myer, Va., followed by interment in Arlington National Cemetery.

Colonel Weeks was a member of the Army Ordnance Association since 1926 and was a director of its Washington Post. He was a familiar figure at the various meetings of the Association and his presence will be sorely missed by all members of the Ordnance fraternity.

On January 1, 1943, Lieut. George W. Elliott, Jr., died at Walter Reed Hospital after a long illness. Lieutenant Elliott was the son of George W. Elliott, a national director of the Army Ordnance Association and a vice-president of the Philadelphia Post. Lieutenant Elliott was a first lieutenant of Infantry. To his father, his friends, and brothers-in-arms, Army Ordnance and the Association membership extend their deepest sympathy.

Notice also has been received of the deaths of the following members of the Association: Archer Anderson, Jr., Richmond, Va.; C. H. Betzenberger, Dunellen, N. J.; Joseph M. Bucher, Detroit, Mich.; J. C. Hays, New York, N. Y.; P. G. Jenks, New York, N. Y.; John D. Lawrence, New York, N. Y.; Kenneth Leith, Amherst, Va.; A. L. Milton, Yorkville, Ohio; Albert H. Morrill, Cincinnati, Ohio; Mabon P. Roper, Rockford, Ill.; Steven G. Sweet, Manhasset, L. I., N. Y.; James B. Taylor, Jr., New York, N. Y.; H. P. Townsend, Hartford, Conn.; Richard F. Walsh, Philadelphia, Pa.; John F. Wyzalek, Bloomfield, N. J. To their relatives and friends, Army Ordnance, on behalf of the association membership, extends condolences.

Ordnance in Review

THE MACHINE GUN—THE PERIOD OF RECOGNITION, PART I

LIEUT. COL. CALVIN GODDARD

This is the first of a new series of articles on the machine gun by Colonel Goddard. The previous series, entitled "The Machine Gun—A Period of Evolution," was begun in the May-June 1942 issue and was concluded in the January-February 1943 issue. The latter series has now been reprinted in brochure form and copies are available without charge to readers of ARMY ORDNANCE. *The first series of these articles, "The Machine Gun—Its Early Applications," was begun in the September-October 1941 issue and was concluded in the March-April 1942 issue. Additional series will be published.*

IN the decade following the American Civil War, the machine gun, despite the setback to its prestige suffered as a result of its tactical misuse in 1870-1871, commenced to come into its own. By 1876, various arms makers, American and foreign, were busy with the production of many makes and calibers. Four types were exhibited at the Centennial Exposition in Philadelphia in 1876. These were the Bailey (Winchester Repeating Arms Company, New Haven, Conn., makers), the Gardner (exhibited by William Gardner, Toledo, Ohio), the Gatling (Gatling Gun Company, Hartford, Conn., makers), and the Palmcrantz (of Swedish origin). All these were labeled "Mitrailleuse," save the Gatling which was captioned, "The Gatling Gun."

Briefly described, the Bailey (Fig 1) was a modified Gatling, its five barrels revolving about a central spindle with an independent reciprocating motion (like the locks of the Gatling) while its single lock remained stationary. The spindle, which bedded into a rectangular supporting frame at front and rear ends of the piece, was keyed to an operating crank at the breech, likewise to a series of disks spaced along it at varying intervals. A cylindrical casing located just forward of the feed mechanism carried on its internal surface a spiral rib. Attached to each barrel, near its breech, were two short lugs which straddled this rib. As these lugs moved along the rib during the rotation of any given barrel, they imparted to the barrel a reciprocating motion. In turn, a feather near the breech of each barrel kept it from turning on its own axis.

A portion of the barrel was cut away at the breech, the part not removed forming a trough which, as it reached the bottom of the feed case, picked up a cartridge. The barrel sliding rearward in the manner just described now brought the case of the cartridge in the trough against a fixed abutment bolt which acted, as the barrel continued to move rearward, to force the cartridge into the chamber ahead. Meanwhile, a short spiral rib on the hub of the first disk became engaged with a lug on the hammer bolt, pressing it back against a spiral spring surrounding the bolt. At a given point, lug and rib became disengaged, permitting the bolt to fly forward and impinge upon a firing pin lying in the axis of the abutment bolt. Thus the cartridge was fired.

Passing the firing point, the barrel commenced to move forward, leaving the empty case caught behind an extracting rib located on the under face of the action cover. Thereupon the freed case fell to the ground.

Cartridges were fed by gravity from a box or clip located as shown in Fig. 1. A continuous feed belt was proposed, empty spaces to be filled manually by a man lying beneath the gun and inserting cartridges into these as the belt progressed. This method of ammunition replenishment must have presupposed either a belt of extreme length, a loader of superhuman dexterity, or a very low rate of fire, as otherwise expenditure would quickly have outstripped supply.

THE Gardner gun (Fig. 2) comprised a set of barrels horizontally disposed and parallel. While the model under discussion possessed six barrels, the gun was capable of being produced with as few as two barrels or even one, though for greatest efficiency two, or some multiple of that number, were recommended. Supported on a sturdy base (*A*, Fig. 2), its mechanism was enclosed in and protected by a tight casing (*D*). Vertically disposed feed slides, one for each barrel, contained columns of cartridges which moved downward by gravity, feeding one at a time through holes in the cover (*D*) to fall into position immediately in rear of the chambers they were scheduled to enter. Reciprocating bolts or plungers, individually equipped with hammer, firing pin, and extractor and all operated by the hand crank (*P*), inserted and discharged the loaded cartridges, then withdrew the empty cases which fell clear of the gun.

Gardner's gun underwent considerable modification during the next few years, as recounted in a description of the weapon as of 1880, by which time the standard number of barrels had been reduced to two. We quote from Charles B. Norton's "Breech-Loading Small Arms" (Springfield, Mass., 1880, p. 338):

"The original gun was invented by William Gardner of

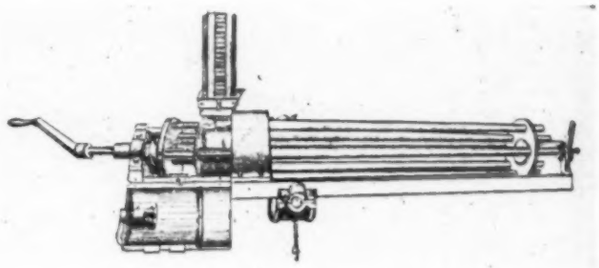


FIG. 1. THE BAILEY MACHINE GUN

Toledo, Ohio, in 1874. In the following year, arrangements for the construction of the gun were made with the Pratt & Whitney Company, and the first gun was carefully tested by the Ordnance Board, U. S. Navy at the U. S. Navy Yard, Washington City, in November 1875. There were present on this occasion Commodore Jeffers, Chief of Ordnance, U. S. Navy, and General Benét, Chief of Ordnance, U. S. Army.

"In this trial the system was greatly commended. Since then, the feeding apparatus has been greatly improved by adopting the one now in use, the invention of Mr. E. G. Parkhurst, of the Pratt & Whitney Company, which is very simple and efficient. The system of swinging levers (known as the Gardner System) that transfer the cartridge from the feed guide to the perforated plate, with the help of gravity, have *(sic)* been superseded by a system that positively carries the cartridge to its place, and retains the shell in position until it is ejected. With these improvements, the gun was again presented to the naval board at Washington, for trial June 17, 1879."

The weapon was subsequently put through its paces by the Army, as told in the following quotation from the same source (p. 350) and dated March 17, 1880, at Washington, D. C.:

"*TRIAL of the Gardner machine gun by the Ordnance Board, U. S. A., composed of Lieut. Col. S. Crispin and T. G. Baylor and Maj. Clifton Comly, Ordnance Department.*

"The Gardner gun, as submitted to the Board and as shown with its carriage on the drawings herewith transmitted, consists of two breech-loading rifled barrels, caliber .45, chambered for the service cartridge, placed horizontally and parallel, 1.4 inches apart, which with the working mechanism are inclosed in a

brass casing. By one complete turn of the hand crank both barrels are loaded, fired, and the shells ejected. The barrels are held in position by rear and front barrel rings pinned to the case. The casing extends sufficiently from the rear barrel ring to contain the lock mechanism, together with the driving crank and safety stop. A swinging cover, hinged immediately over the rear barrel ring, gives easy access to all working parts of the gun in case of defective cartridges, derangements of locks, or other accident. The cover when closed is secured in position by a few turns of the cascabel, which for that purpose has a screw-thread cut on its neck or stem entering the rear of the case.

"The hand crank that operates the gun is pinned fast to the main crank, which is supported by journal boxes. The boxes are locked into the rear case, and serve as a protection to the swinging cover from side thrusts. The body of the main crank is circular, having journals or crank pins for operating the locks diametrically opposite each other—the firing being alternate—and eccentric enough to give the required motion to the locks as they are moved forward and back, driving in cartridges and withdrawing shells. The outer portion of the crank pins or journals are flattened to the circle of the periphery of the main crank for the purpose of holding the lock stationary while firing, about one-fifth part of the revolution of the hand crank allowing time for hangfires.

"The lock in form resembles the letter U, having an extension from its side which contains the firing-pin mainspring sector or spring compressor, sector sleeve, extractor, and lock head.

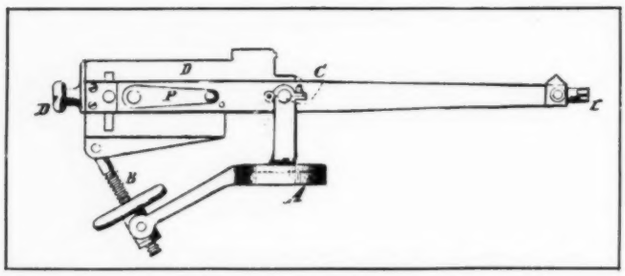


FIG. 2. THE GARDNER MACHINE GUN

The U part of the lock that works under and around the crank pin is curved at the inner front to correspond with the outer circle of the crank, the office of the curved front being to hold the lock in position for firing. The circular firing pin is flattened a portion of its length near the front end to allow it to pass under the extractor by which it is held in position. It extends from the head of the lock through the mainspring and sector sleeve, terminating in a flange or head for locking into the sear. The sear, having the form of a bell crank, pivoted in the center to the lock, holds the firing pin securely and prevents its forward motion until it is released from its hold by the action of the crank journal when the lock is in its extreme forward position.

"The sector or spring compressor, hinged in a recess of the lock and engaging by means of gear teeth with the sector sleeve, has its arm forced against the safety-stop as the main crank advances, thus compressing, through the medium of the sector sleeve, the mainspring and holding it tense until released by action of the sear.

"The lock heads serve as breech plugs and receive the recoil when the cartridges are fired. Each lock carries a hook extractor, which rides over and catches the flange of the cartridge when the lock is forced forward, and when the lock retreats withdraws the empty shell until it comes within reach of the ejector, by which it is positively thrown out. The shell starters have a positive movement in connection with the lock head. Should the cartridge be driven by the extractor into the barrel to its head (as is the case when the gun is worked rapidly) before the lock is in firing position, it is forced from the chamber by the shell starter as the lock advances and is held long enough for the extractor to engage with the head, when the lock, extractor, and cartridge are driven home together.

"The ejectors, hinged to the case, are driven by projections on the sides of the locks, which give them lateral movements to eject the empty shells, or full cartridges in case of misfires. They also serve as stops to prevent the cartridges from falling through the perforated plate as they are forced down through the feed valve.

"THE perforated plate extending across the rear case, to which it is fastened by a pin, has two parallel semicircular grooves, which are enlarged extensions of the chambers in the barrels. From the back part of the groove, slots large enough to pass a cartridge freely (being wider at the rear behind the ejector than at the front) are cut downward through the plate. When the retractor has drawn the shell back nearly to the extent of the throw of the crank, the ejector forces the shell through the slot and is then in position to receive another cartridge from the feed plate or valve. The feed valve, attached to the swinging cover, has a reciprocating motion across the perforated plate. It has two angular openings of the size and shape of the outline of the cartridge, with centers equidistant with centers of the barrels. After a cartridge has dropped one-half its diameter into the valve it is forced by the action of the latter into its true position and held positively against the cartridge support. When the valve is again moved back, the cartridge is forced downward into the perforated plate and the column of cartridges is cut off in the swinging cover-feed ways, which are extensions of the feed guide that is located above and in line with the plate.

"The feed valve is driven by the feed-plate lever. This also is attached to the swinging cover and is operated by the locks, using about one-eighth the stroke of the crank in its forward motion, thereby giving the valve time to hold both cartridge and shell down in position as they move in and out from the barrel. The feed guide is a simple plate, having two parallel T grooves extending from end to end, their centers equidistant with the centers of the barrels. The upper end of the guide has a trumpet-shaped mouth to facilitate the entrance of the cartridge heads. The lower end is provided with a cartridge stop, which lifts all cartridges contained in the guide when it is taken out from the swinging cover by which it is supported. The guide is held fast in firing position by a spring catch. It can be quickly released by drawing back the spring catch by pressure on its exposed arm. In placing the guide in position the spring catch becomes self-acting. These operations require but one hand, leaving the other free to place the safety-stop arm in position.

"The safety stop is an oblong block having an angular face, against which the arm of the sector in the lock may engage when the locks are moved forward by the crank. It is held in position by two links, which are moved by an arm that is pinned fast to a shaft passing through the rear case, to the outer end of which is pinned the stop arm. This arm is constructed in the form of a hand crank, having a stop spindle placed in its handle, behind the shoulder of which is placed a spiral spring that forces the spindle out from the arm into the stop holes, two in number, in the rear case. When the stop spindle is in the upper hole the arm is in line with barrels, the safety stop is thrown within reach of the sector arm, by which the main springs are compressed, and the gun is in firing position. When the spindle is in the lower hole, the stop is carried forward out of the way of the sector arm, and in no case can the springs be compressed while the safety arm is down.

"The cartridges are contained in perforated wooden blocks (holding twenty each), channeled on the sides for receiving the fitted tin covers in the manner adapted to the Gardner gun. The cartridges thus arranged are simply and readily conveyed through the feed guider to the gun, and as the block is emptied before the cartridges previously inserted are expended a continuous fire can be sustained." (*To be continued.*)

From the Record

OUR ORDNANCE AT THE FRONT

A WELL-TRAINED American soldier, well equipped, with good leaders, can prevail against any other soldier in the world. We are giving him the training; to give him the leadership, our officer-candidate schools are turning out thousands of splendid junior officers every month. We are giving him the weapons, too. The strides which were made during the year 1942 in producing planes and guns and tanks for our soldiers have never been equaled. You have heard much, and rightly, of the achievements we have made in manufacturing vast quantities of munitions. I want you to know that not only is our record in quantity unsurpassed but so is our record in quality.

Rommel's troops never knew what hit them when they encountered the General Sherman tanks at the Battle of El Alamein. British officers, and ranking German officers who were captured, said that this tank was the best tank in the desert. One report to the War Department on these tanks said this: "There is every evidence that, although the enemy knew we had a new type of tank, they grossly underestimated its performance, ability to withstand fire, and the number available."

But it was not only tanks; our tank-destroyer weapons stopped their *Panzer* divisions short. That weapon was a 105-mm. howitzer on a self-propelled mount. Last September, an artillery regiment in the British Eighth Army was completely equipped with it. We call it the M7 [illustrations on pp. 277 and 299]. Officers and men of this regiment, after using the M7 at El Alamein, said it performed splendidly, suffered no technical trouble, and was responsible for the low rate of British casualties in the offensive. The M7 is heavily protected with armor—not one of them was knocked out in that battle by Nazi artillery or Nazi bombs.

You have heard much of the performance of our planes in Europe, in Africa, and in the Pacific. Our bombers and our pursuit ships have met the best the enemy has had to offer, and they have come off first best. From February 1 to December 31, 1942, the Army Air Forces destroyed 987 enemy planes in aërial combat.—*Robert P. Patterson, the Under Secretary of War, to the Sixth Biennial General Assembly of the Council of State Governments, Baltimore, Md.*

INDUSTRY AND THE WAR

THE machines which you have built are now being tested in battle around the world—planes, tanks, guns, vehicles, ships, and a world of electrical and similar devices. They are meeting the test. Our munitions are as good as the best of the enemy's—usually better. This was to be expected. Our problem, however, was to get them in quantity, in time, to the various theaters. That has been our desperate struggle of the past year while your equally desperate struggle has been to produce at a more rapid rate than was previously believed possible.

I am familiar with some of your difficulties—shortages in raw materials, loss of skilled man power, changes or conversions in design. You have been asked to change overnight from established practices for manufacturing equipment designed to increase the efficiency and comfort of your fellow man to weapons purposely designed to destroy him. . . . The speed with which you have made these changes is a convincing demonstration of the flexibility of the American system.

The news from the various fronts in the past few weeks has been encouraging, but I am disturbed by the rapidity of the change from a speculative pessimism to undue optimism regarding the course of the war. Nothing could be more dangerous to the success of our arms than the development of a national attitude that the victory is about to be won. We are faced with a long ordeal, and it is imperative that we devote every resource we possess to the relentless crusade which has just been started. The situation requires confidence and determination far beyond that ever before demanded of the American people.—*Gen. George C. Marshall, Chief of Staff, U. S. Army, to the National Association of Manufacturers, New York, N. Y.*

AMERICA'S AIR POWER

WE are building overwhelming air power—on schedule. Our monthly airplane production is over 4,000. Our great expansion program now under way will double that output. We will need those extra planes, because this is an aërial war in which one or the other of the combatants will be driven from the sky—and it won't be us! From February 1 through December 5, 1942, the Army Air Forces definitely destroyed 928 enemy planes and probably destroyed 276 in aërial combat. We have lost 130 of our own and 104 are missing. As the result of aërial fighting, the score stands 928 enemy planes knocked out against 234 of ours. Hence the ratio of planes lost is about four to one in our favor. . . .

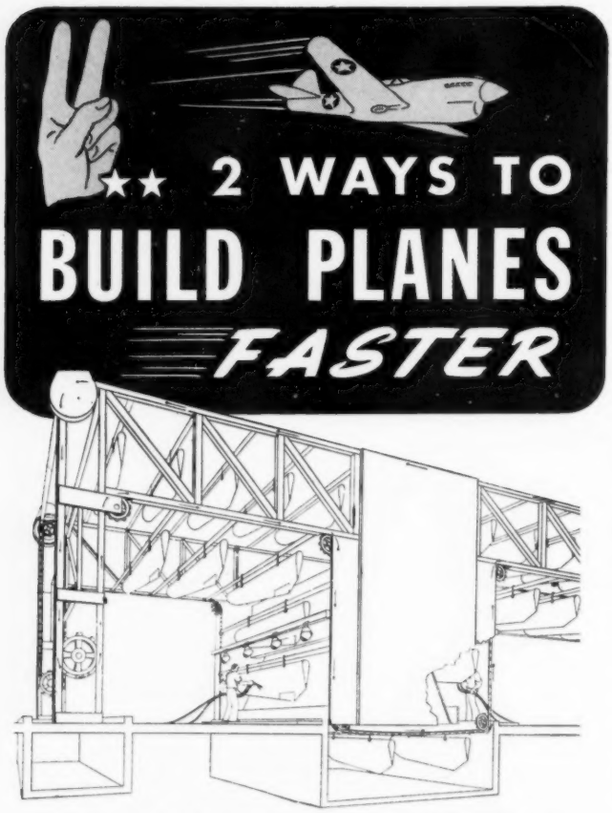
Neither the Germans nor the Japanese have come out of their combats with our Air Force without having to stop for breath and lick their wounds. The terrific destruction wrought by the Flying Fortresses upon the best fighters that Goering could bring to bear against them came as a distinct surprise. These trained German fighter pilots tried every technique that they could conjure, but the results have always been the same. The Flying Fortresses fight their way through—leaving wrecked enemy fighters behind—and complete their missions.

To date we have had over 1,063 different sorties against the Germans and have lost, up to November 30th, a total of 32 planes. That total is for our losses by both aircraft and antiaircraft. During those sorties we have definitely destroyed 293 enemy planes, probably destroyed another 150, and have damaged 192. That is a record unequaled by bombers of any other nation. However, we must not rest on our laurels and think smugly that all is well, for we know it will not be long before the Germans come out with an answer to our Flying Fortresses, and we must be ready for it when it comes.

For a long time we had our P-38's in England and tried vainly to get them into a fight to determine just how good they were. The Germans would not close in and fight. Recently, however, the Germans have fought us in the area over Tunis. To date the P-38's have held their own, even though they have had a very difficult task. They have covered and protected the ground troops, and at the same time met the German Messerschmitt 109 and Focke-Wulf 190 fighters. The number shot down has been about even, so we are satisfied; if we can always shoot down plane for plane with the Germans, it will not be long before we have definite air control, for we can not only produce more planes than they can but we can also turn out more and better combat crews.

Both the German and the Japanese Air Forces are on the downgrade—they have passed their peak. We are just approaching our peak in airplane production and combat-crew training. Our plane production alone is more than that of the Germans and Japanese combined; however, we have the production of the British and the Russians on our side, too. So, despite the long pipe lines which we must keep filled, our enemies are playing a losing game in the air. They are reluctant to meet us in an all-out combat, and yet if they do so meet us, it marks the end of their control of the air, even over their own countries. . . .

Our fliers are the best in the world. One reason is that we give more hours of actual flying in our training than do others. Our pilots now get over 250 hours in school with another 200 in our operational-training units before reaching the combat thea-



★ With the coöperation of Fleetwings, Inc., engineering staff, Alvey-Ferguson engineers designed and built this A-F "endless-stream," overhead conveyor system which moves parts at exactly the right speed for continuous processing at high efficiency. Unused ceiling space was used to boost production without increasing floor space. . . . Other types of A-F Conveying Equipment have helped other airplane manufacturers produce planes faster and thus bring the day of Allied Victory nearer.

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From the Record

ters. In the last war, the average was ninety hours before going into combat. Eddie Rickenbacker, our ace of aces, had but thirty-five. . . .

During the past twelve months our research-engineering program has been vastly accelerated. I cannot reveal the most gratifying developments; however, our caliber .50 machine guns have proved themselves to be terrific weapons of aërial destruction. They are one of the outstanding successes of the war, in which Americans can take just pride. But listen to this: Our highly destructive caliber .50 machine guns will seem like peashooters compared with the fire power that we are putting into our newest big ships. We have steadily improved our standard models of fighters and bombers. Some time ago I said that the B-17 and the B-24 were perhaps the last of the "small" bombers. We have new fighters and bombers on the way with tremendously increased speed, fire power, bomb loads, range, and maneuverability.

Not long ago the Tokyo radio announced that the Japanese public could expect to be raided again by American bombers before the war was over. For once, I will say to Tokyo, "You are right!" Yes, we are coming, and we hope to make it soon, and when we do come it will be in large numbers, and we won't stop with one visit—we will return again and again.

Our glider program is proceeding on schedule. Our newest transports will carry more freight and more men. Our newest motors, both air-cooled and liquid-cooled, have been vastly stepped up in horsepower. Photographic reconnaissance on our combat fronts is increasing in effectiveness due to new developments in cameras and photographic technique. Our pursuit planes can take good pictures at 300 miles an hour, from 30,000 feet, accurately enough to show up individual railroad ties. We have passed the Axis in many research developments, but we shall not be satisfied until we leave them far behind in all of them.—*Lieut. Gen. Henry H. Arnold, Commanding General, Army Air Forces, to graduating air cadets at Randolph Field, Tex.*

THE SERVICES OF SUPPLY

JUST what is S.O.S.—the Services of Supply? It handles logistics and administration. Its purpose is to take these loads, as far as possible, off the mind of the Chief of Staff. It is the biggest business in history, the most widespread geographically. It employs more people, owns more land, spends more money, handles more merchandise than any other organization the world has ever known. Still you don't begin to get the picture. For in addition to these functions, there are attached to S.O.S. all the administrative duties not actually a part of Ground Forces or Air Forces.

From the moment an American soldier holds up his hand to be sworn in until he is discharged at the end of the war, S.O.S. takes care of him. It feeds him, clothes him, houses him, transports him, schools him in many or all of his duties. It looks after his morals and his manners. It tries to keep him happy in 2,000 Army motion-picture theaters where he sees films fresh from Hollywood at an admission price of 12½ cents—and thus it becomes the greatest showman in the world. It feeds some fifteen million meals a day, bakes more bread than any other hundred bakeries in the world, launders more clothes than all the other laundries, mends more shoes than all the other cobblers, patches more tires than all the other repair shops, provides more beds than all the hotels.

The 60,000 military police keep order among soldiers in troop concentration points—and they are part of the S.O.S. Army courts that try the soldier when he misbehaves are under the direction of a section of the S.O.S. The chaplains who minister to the soldiers' spiritual needs are part of the S.O.S. The Army exchanges, the camp and post stores that sell cigarettes, chewing gum, toothbrushes, candy bars . . . are part of S.O.S.

From the Record

The Services of Supply builds the Army's roads and camps and hospitals. In the past two years, the S.O.S. has undertaken nine billion dollars' worth of purely military construction, and already has completed three-fourths of what it undertook. If all the concrete runways we have built on Army airfields were spread out side by side, they'd pave our smallest state of Rhode Island from border to border. If all the Army land we've bought for camps and fields and target ranges and other installations were lumped, it would cover more than half of England. That's a lot of real estate!

The S.O.S. operates the Army telephone and telegraph lines and the biggest radio network in the world. It nurses the sick soldier and binds the wounds of the soldier who is hurt. It keeps the Army's accounts, carries part of its mail, pays the soldiers and civilian employees, clothes every individual soldier, designs his weapons, oversees their manufacture, takes them to him where he needs to use them. That's the job of S.O.S.—*Lieut. Gen. Brehon B. Somervell, Commanding General, Services of Supply, U. S. Army, to the Academy of Political Science, New York, N. Y.*

Fire Power for Victory

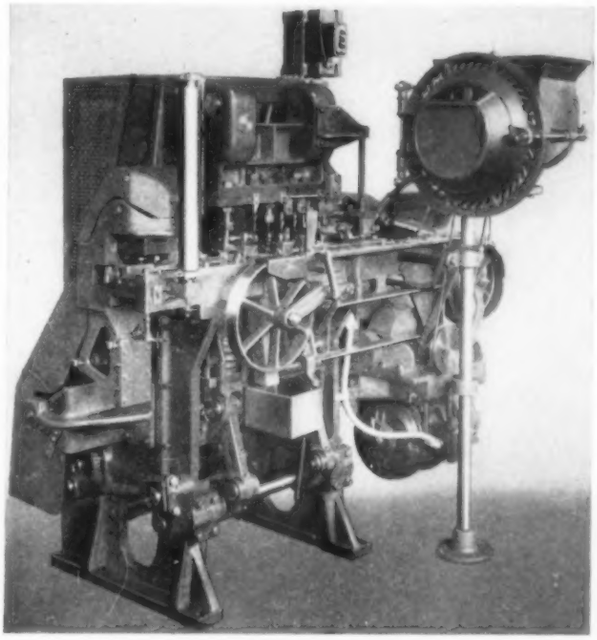
BY now the United Nations are outproducing the Axis and its slave territories, but they have only recently passed them. The Axis had a headstart; it had been accumulating fire power for years. The United Nations must build up a surplus which supplies the difference in fire power needed to conduct an offensive against defensive forces. The United Nations must become as much stronger than the Axis as the Axis was stronger than the half-armed world which it attacked.

When that surplus in fire power is there, and the trained men are there to use it, the war probably will not last as long as it will have taken the United Nations to build up the surplus. So the greatest industrial effort ever conceived by man has to be made. The greatest service to victory will, to be sure, be made on the battlefield at great cost in life. But the victory will be won only in part by the fighting soldier. Part will be won by the makers of fire power. It will be won by the surplus which they have built.—*Raymond Gram Swing, commentator, in Fire-power.*

The Caliber .50 Aircraft Machine Gun

THE great success of our aviation in combat is due, first, to the superiority of our fliers over any others. Secondly, it is due to the caliber .50 machine guns with which our planes are armed. In the last war, two-thirds of all casualties, almost all of the serious ones, were inflicted by artillery fire. Almost all the bullets were delivered by machine guns. Machine guns and barbed wire rendered attacks so costly as to be almost impossible. Before the war there had been armored cars and track-laying tractors; these two principles were combined into the tank for two main purposes—to cut the wire and run over machine-gun men. The tank was armored to withstand caliber .30 machine-gun bullets. Therefore, the tank-stopping caliber .50 machine gun was invented. Before the outbreak of the war of 1939, tank armor had become too strong for the caliber .50 machine gun. Fortunately, some heaven-sent man put it into our aircraft in this war. Its advantages are that at the range at which airplanes engage it is going to penetrate any armor any airplane may carry, destroy any motor, blow up any gas tank. Other countries employ caliber .30 machine guns which can be stopped by our armor, sometimes resisted by our engines. They employ 20- and 37-mm. cannon. The weight of their guns is such that only one or two of them can be carried against many caliber .50 machine guns in our fighters and bombers.—*Col. Robert R. McCormick, editor and publisher, the Chicago Tribune, on Mutual Broadcasting System.*

SMALL ARMS
AMMUNITION
MACHINERY



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One of our large family of Small Arms Ammunition Machinery. This line is the outgrowth of long experience in the development of machinery for the mass production of bullets, cartridge cases, etc., and the handling of explosives.

While the equipment is used extensively in U. S. Government Arsenals, the line includes also various machinery adapted to the manufacturing practices of England, Canada and other foreign countries.

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A Cartoon Commando

"JOE DOPE" PROMOTES PREVENTIVE MAINTENANCE WITH LAUGHTER

BRIG. GEN. H. R. KUTZ*

NEWEST addition to the Ordnance Department's training staff is a likable blunderer named "Joe Dope." His specialty is making an utter fool of himself—to teach his friends a lesson. At Army posts, camps, and stations around the globe, officers and enlisted men are learning that lesson—the importance of proper care of their equipment—as they chuckle over the latest

No obstacle that he may meet
Ever forces Joe Dope to retreat,
For he thinks that a tire
Is immune to barbed wire—
Which it ain't (any more than his seat)
Don't be a dope!
HANDLE EQUIPMENT RIGHT

"JOE" SETS A HORRIBLE EXAMPLE

"Joe Dope" poster. For "Joe" is a cartoon character who does everything wrong, a slapstick comedian who demonstrates, amid scenes of havoc, that carelessness does not pay.

The use of humor as a medium for preventive-maintenance education dates back to August 1942, when the "Joe Dope" poster series received the approval of Maj. Gen. Levin H. Campbell, Jr., Chief of Ordnance. The story behind the project is an interesting one. The designing of a new gun requires little more technical knowledge—surely no greater appreciation of field conditions—than that which went into creating "Joe." His originators knew their "audience," the men responsible for the care of Army equipment. They evolved a sound psychological approach—the device of offering readers a laugh at the expense of "Joe Dope"—then leaving them to wonder if they are laughing at themselves. By making carelessness ridiculous, the posters effectively discourage it. "Don't be a dope!" warns the text, *"Handle Equipment Right!"*

*Chief, Military Training Division, Ordnance Department. Brigadier General, Ordnance Department, U. S. Army.

The tank crew is sore as a boil
For it just aint according to Hoyle
To get caught in a spot
So exceedingly hot —
Joe Dope had checked all - but the oil!
Don't be a dope!
HANDLE
EQUIPMENT RIGHT!

"JOE" JOINS THE ARMORED FORCE

The posters have introduced "Joe Dope" to Ordnance personnel everywhere. More are now being prepared, and, as General Campbell has stated, "forty-four more will go out if necessary." Thus "Joe Dope" is already famous as the cartoon commando of the Army's preventive-maintenance offensive—almost as famous, possibly, as "The Spirit" of the comic strips which Corp. Will Eisner also draws.

Preventive-maintenance officials do not expect, of course, that these posters will abolish the abuse and neglect of Army equipment overnight. But they do anticipate a growing respect for proper methods of care, a sharper awakening to the fact that preventive maintenance is as vital a phase of training as combat techniques. The Canadian Government's request for permission to adopt "Joe Dope" is another of many pronounced indications that humor, as a training medium, is gaining wider military acceptance. "Joe Dope," meanwhile, is conclusively demonstrating his ability to win friends and influence people—in behalf of more and better preventive maintenance everywhere. The posters themselves show how. What more need be said!

Joe Dope camouflaged his Garand
By burying it deep in the sand;
He leapt from the mire,
But the gun wouldn't fire—
So the Nazis took Joseph in hand!
Don't be a dope!
HANDLE EQUIPMENT RIGHT

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Hydro-Sealed by floating water blanket, new high-performance Carbon Gum Digestive Solvent cleans carbon and paint from aircraft engine parts without harmful effect. Used hot, water seal prevents escape of solvent vapors. (Data Sheet #95)

High Potency Concentrate makes Self-Emulsifying Grease Solvent to remove insulating coats of grease and dirt from truck, jeep, tank, and automobile engines by emulsification and utilizing the heat of a warm engine. Cleaned engines operate more economically since original thermal efficiency is restored. (Data Sheet #96)

Unique Oil removes salt; may be applied to metal surfaces wet with sea water. Cleans, dehydrates and leaves thin film of rust-preventive compound. Suitable as a cleaner-preservative and lubricant for small-arms bore cleaning. (Data Sheet #97)

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Sparkling Clear, water-in-oil cooling compound emulsion facilitates work inspections without stopping tools in metal-cutting and grinding operations. (Data Sheet #101)

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Instrument Shampoo emulsifying solvent cleans optical lens and delicate mechanisms without harmful effect. Results in physically clean work and complete absence of any film. (Data Sheet #103)

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Non-Caustic Emulsion cleans brass and steel shell cases. Solution may be handled safely by women. Cold or hot solutions are effective. (Data Sheet #105)

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Gunk . . . this versatile base concentrate when diluted with appropriate solvents anticipates every automotive, military, and industrial grease-cleaning problem. (Data Sheet #107)

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Preventive Maintenance

PART II: THE DRIVER'S RÔLE IN THE FIELD

BRIG. GEN. J. KIRK*

IN mechanized warfare, preventive maintenance is a prime prerequisite of victory. And the starring rôle in preventive maintenance has been assigned—logically and inevitably—to the soldier-driver. He is the Johnny Doughboy-on-the-spot, the man best situated to perform preventive-maintenance operations. To make certain that he is also best qualified, the Army has geared its huge driver-training program to a proven set of standard preventive-maintenance schedules (PMS's) developed through the collaboration of military and automotive experts. A brief history of these schedules, for wheeled and half-track vehicles, appeared in the last issue of ARMY ORDNANCE (Vol. XXIV, No. 136, p. 110).

These schedules reduce to specific essentials "the systematic detection and correction of incipient causes of vehicle casualties before they occur and the operations necessary to maintain satisfactory day-to-day operating condition of motor vehicles" (from the definition of preventive maintenance in Army Regulation 850-15). By establishing standard training procedures, the schedules serve to define the driver's inspection and servicing responsibilities, together with his maintenance limitations.

As a result of his training in the actual PMS operations, the "graduate" driver is well equipped to play his vital preventive-maintenance rôle in the field. He carries the "what-to-do" in his head, the "how-to-do-it" in his hands. He understands the necessity for proper vehicle care, the penalties of vehicle abuse, the paramount importance of first-echelon maintenance in a war of machines. In short, the driver knows his job. Its preventive-maintenance responsibilities, outlined in the standard preventive-maintenance schedules, add up to an impressive total as indicated by the following summaries:

PMS No. 2: "After Operation."—Inspection of a motor vehicle after operation is essential enough to be required, in basic form at least, even in extreme tactical situations. At the conclusion of any tour of operation, the driver has an opportunity—and an obligation—to make sure that his vehicle will be ready to roll again on a moment's notice. He investigates any irregularities discovered during operation and looks for any other deficiencies, any further hints of trouble, which may have developed.

Of the five schedules assigned to drivers (first echelon), PMS No. 2 is by far the most thorough—a fact which underscores its worth. The prescribed routine begins in the driver's seat before the engine is stopped. Here the driver tries the hand brake, listens to the sound of the idling engine, checks the reading of gauges and meters on the dash, turns on the windshield wipers, heater, and defroster. The driver then dismounts and looks under the hood—with the engine still running. He notes any excessive vibration, checks the operation of the fan belt, inspects ignition wires, carburetor and controls, engine mounting bolts, fuel and oil lines, firmness of accessory mounting.

Back in the cab, after stopping the engine, the driver tries the horn (unless the tactical situation calls for silence), checks the fire extinguisher and decontaminator, rear-view mirrors, ammeter and voltmeter. Under the hood, now that the engine is stopped, he looks for leaking water, oil, or fuel; he checks the radiator, fan-belt tension and condition, etc.

Continuing his inspection, the driver crawls under the vehicle and turns his attention to such vital units as the steering mechanism, springs and suspensions, brake lines and air-brake reservoirs, the transmission, transfer case, propeller shafts and

*Chief, Maintenance Branch, Field Service Division, Office of the Chief of Ordnance. Brigadier General, Ordnance Department, U. S. Army.

driving axles, the muffler and tail pipe. He cleans and lubricates wherever inspection reveals the need. He inspects all tires, including the spare and its carrier.

To wind up PMS No. 2, the driver makes an inspection tour around his vehicle. He checks all the lights and warning reflectors, cleans the windshield, examines sheet-metal and wood body parts; he inspects the wheel and axle-flange nuts, the brake drums and wheel hubs, power take-off and winch, the bumpers, towing hooks, pintle and safety chains, the load, tarpaulin and fastenings, tractor fifth wheel and plate, trailer lighting and brake connections. On a half-track, he checks the front rollers, tracks and suspensions, sprockets and grousers. With any vehicle, he inspects all tools, traction devices, and other equipment. Finally, he refuels the fuel tank.

PMS No. 3: "Before Operation."—This schedule is designed as a quick "once-over" to make sure that the condition of a vehicle has not changed since the last PMS No. 2. This precaution should never be neglected. It makes possible the timely discovery of sabotage, tire deflation by slow leaks, etc.

The well-trained driver can make this before-operation check almost automatically, in a few minutes' time. Before starting the engine, he glances over the vehicle generally, takes a look under the hood, peers under the vehicle for signs of leakage on the ground. He checks the water, oil, and fuel levels, which should be just as they were left after operation. On starting the engine, the driver notes how the starter is functioning. While the engine warms up, he inspects the instrument panel, horn, windshield, load, tarpaulin and fastenings, tractor fifth wheel and plate, trailer lighting and brake connections, tools, traction devices, and other equipment; he inspects the tires and steering gear. On a half-track vehicle, he checks the tracks, track suspensions, and sprockets. At the wheel, before starting out, the driver accelerates the engine several times, listens for any ominous noises, and runs his eyes over the instrument panel.

PMS No. 4: "During Operation."—It is second nature for a good driver to observe the behavior of his vehicle as he drives. This PMS simply points up the importance of being on the alert for signs of trouble—unusual sounds or odors, improper action of instruments, faulty steering, brakes, clutch, etc.

PMS No. 5: "At Halt."—Every halt in operations, however brief, gives the driver an opportunity for sizing up the condition of his vehicle. The procedures at this point may be purely precautionary or they may involve correction of a condition noticed during operation but which was not urgent enough to require instant attention. The actual check list for PMS No. 5 is basically a condensation of that for PMS No. 2. While only one-third as long, the list covers the most essential items—those most likely to develop trouble or those whose failure would have the most serious results. This PMS is considered the "battle minimum."

PMS No. 6: "Weekly."—A regular weekly sequence of preventive-maintenance operations must supplement the more frequent routines. This PMS involves the inspection, tightening, and servicing of certain vital units which directly affect vehicle performance. It also prescribes a general clean-up, inside and out, to keep the vehicle's appearance up to military standards. During this weekly PMS, the driver attends to such details as the cab floor, interior and upholstery; the clutch pedal; body hoist (if any), body generally, fenders, bumpers, towing hooks, pintle, and safety chains; tractor fifth wheel and plate; door latches, handles, hinges, glass regulators; steering knuckles and shock absorbers; bolts on the transfer case, power take-off and differential housing; brakes, winch, battery, and wiring; tires or tracks (with suspensions and sprockets). A complete lubrication check and engine cleaning are also specified.

Summing up, the driver's rôle in the field is to "go places and do things." The Army's whole preventive-maintenance program—the Army's very mobility—depends on the things he does and how well he does them. (The next article of this series will treat the mechanic's rôle in the field.)

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Foreign Weapons

The German 7.92-mm. Machine Gun, MG 34

Lieut. M. F. Medlin*

Ordnance soldiers in the present war may have many occasions to salvage and repair captured enemy equipment for emergency use by our troops. Therefore, the following description of an important and widely used enemy weapon, the German machine gun, MG 34, should be of interest to Ordnance troops in the field and to soldiers of the Ground Forces who may find occasion to operate such enemy matériel.

The MG 34 is the standard machine gun of the German Army. It is a short-recoil-operated, belt-fed, air-cooled, dual-purpose gun with a caliber of 7.92 mm. (cal. .312). It has an over-all length of 48 inches and a barrel length of 23½ inches. The rifling has four lands with right-hand turn. The gun has a rate of fire of 800 to 900 rounds a minute. It is equipped with a blade fore sight and an open U rear sight, graduated from 200 to 2,000 meters, and also has auxiliary antiaircraft sights. The gun, with bipod, weighs 26½ pounds.

This gun is referred to as "dual-purpose" since it can be used as a light machine gun on a bipod or as a heavy machine gun with a tripod mount. On a suitable mount it is also used for antiaircraft purposes. In some cases a twin antiaircraft mount is used on which a pair of guns is mounted side by side.

Belt feed is normally employed, although the German machine-gun handbook refers to a 75-round cartridge drum. When using this drum, a different type of feed cover is used. This cover is provided with a feed opening in the top which, when the drum is not in position, is closed by two hinged dust flaps. When using this cartridge drum, the feed block must be removed.

Each belt contains fifty rounds, but it is common practice to join as many as five belts end to end. At one end of each length is a small semicircular tongue, and at the other end of the last link is a rectangular hole. To join lengths, the tongue of one length is slipped through the hole in the last link of the other length and between the round and the link until a small projection on the tongue springs into place. The round holds the two parts together. To separate the two lengths the connecting round is withdrawn. This indicates that belts can be added to one already in the gun without interrupting fire.

This gun was subjected to various tests at the Aberdeen Proving Ground, and some of the conclusions arrived at by the proof officers are as follows:

It had been reported previously that the gun was extremely easy to manufacture and that most of the parts could be turned out on a lathe. At first glance that appeared to be true—most of the parts have a generally circular appearance. But a study of the bolt alone revealed many milling cuts of an intricate nature. This bolt was shown to numerous American manufacturers, and all of them made high estimates as to the cost of this one item. Other parts of the gun that require difficult milling operations are the receiver, the rear of the jacket where it breaks to remove the barrel, the trigger mechanism, and the feed cam. The rest of the gun appears readily manufacturable which might tend to balance the difficulties of making the above-mentioned parts, but this is doubtful. It would not, however, be easy to manufacture on a mass-production basis.

The gun is quite simple and is especially easy to disassemble in the field, and its general functioning is excellent, but it is extremely critical as to adjustment, lubrication, and foreign matter. Its full-automatic accuracy is very poor due to the

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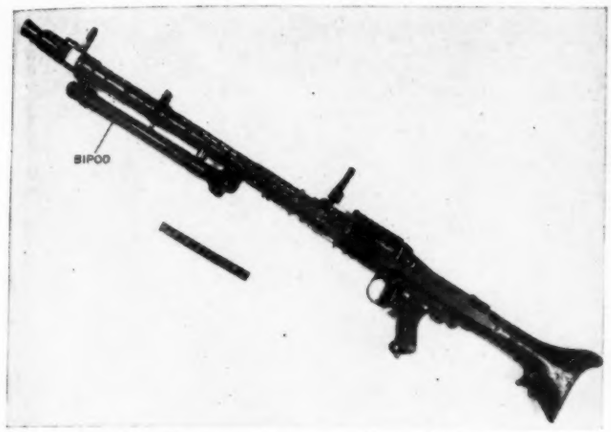
severe recoil, its rate of fire is too high for a light machine gun, and its functioning in dust and in extreme cold is poor. However, its stability is good due to the point of support being a direct prolongation of the bore, its ease of changing a hot barrel is excellent, its belt lift is good, and its resistance to heat is very good.

In general, the MG 34 may be said to be a gun neither adaptable to American manufacturing methods due to the critical nature of the parts nor to the American soldier because of its inaccuracy.

INSTRUCTIONS for changing the barrel and stripping the gun are summarized below:

Changing barrels: Cock the gun and set to "safe." Depress the body catch just below the back sight pivot and turn the body nearly 180 degrees to the left. Raise the muzzle and allow barrel to slide out. Lower muzzle and insert fresh barrel, turn body to the right until body catch reëngages. Set to "fire," hold cocking lever with right hand, press trigger, and allow breechblock to move forward slowly. A barrel is generally changed after about



THE GERMAN MACHINE GUN, MG 34

250 rounds have been fired at "continuous" or with only short pauses between bursts, but statements from prisoners of war indicate that up to 400 rounds are fired in an emergency.

Bipod: Raise fore sight pillar. Press catch beneath the front end of the barrel casing. Rotate the bipod slide out of its guide and remove.

Feed block and feed cover: Push catch forward on rear end of feed cover, fold feed cover forward. Lift out the feed block. Press the feed cover axis pin from right to left and remove the feed cover.

Butt: Press the butt catch below the butt, rotate the butt a quarter turn, either right or left, and remove.

Buffer housing: Press the buffer catch beneath the rear end of the body, rotate buffer housing a quarter turn anticlockwise and remove. At this point the return spring may be removed.

Breechblock: Remove the breechblock by pulling the cocking handle to the rear.

Trigger group: Remove the trigger group which is held to the gun body by two self-locking retainers. (Pinch the split ends of the retainer together and push out.)

Body: Depress the body catch, which is located on the left side immediately underneath the back sight, and turn the body anticlockwise nearly 180 degrees. Push the body locking pin catch upward and remove the body. The body locking pin catch is located on the right side of the barrel casing extension; *i.e.*, to the right of the back sight pillar axis pin.

Barrel: Remove the barrel from the barrel casing. Raise the front end of the flash-eliminator catch and unscrew the flash eliminator (right-hand thread) from barrel casing.

When this weapon is set to the "safe" position, the letter "F"

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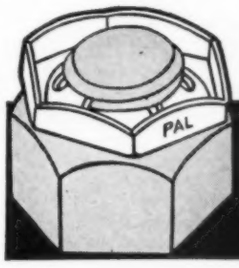

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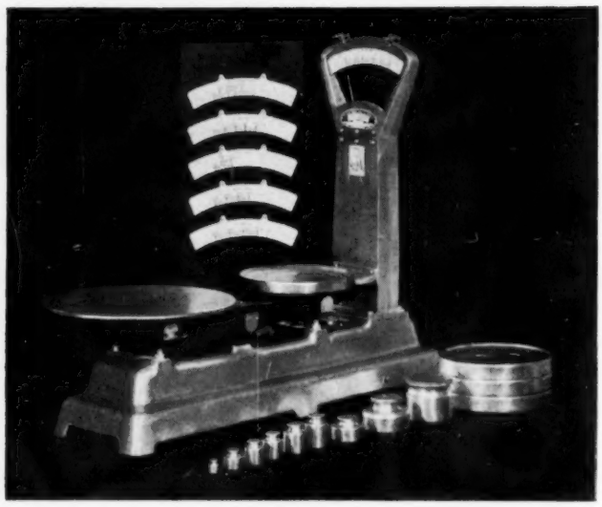

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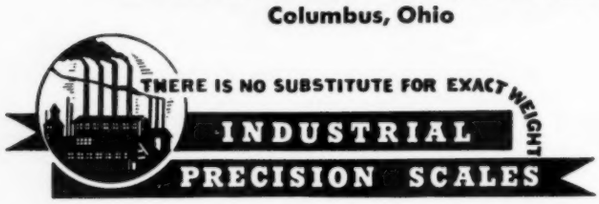
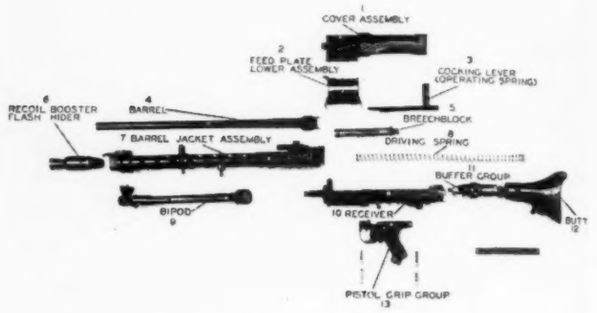


Foreign Weapons

is uncovered and the letter "S" is covered by the safety lever. When set to fire, the letter "F" is covered and the letter "S" is uncovered.

To load using the metallic belt, insert it in the feed opening on the left side of the gun (the feed cover may be either open or closed) so that the first round will be engaged by the three pawls on the under side of the feed cover. Cock the gun and then push the cocking handle back to its forward position. For single-shot firing, press the top part of the trigger marked "E". For automatic firing press the bottom part of trigger marked "D". To remove the belt, cock the gun, raise the cover, and lift the belt out. Grasp the cocking handle, pressing the trigger at the same time and allow the cocking handle to move forward slowly.



The German Gun, Field-Stripped

THE gun has a short barrel recoil of 3/4-inch. During the first 3/16-inch of recoil, the barrel and breechblock move back locked together. During the remaining 9/16-inch travel, the barrel and breechblock unlock. There is no accelerating device to assist in the backward movement of the recoiling parts. Energy for the counterrecoil is obtained by the compressed return spring. Energy for the return of the barrel to its fully forward position is accomplished by the compression of the barrel buffer spring in the recoiling movement.

The breechblock is locked to the barrel in the firing position by means of interrupted screw threads. There are two buttress threads on each side of the breechblock head which engage corresponding threads inside a cam sleeve fixed to the breech end of the barrel. Two shoulders on the periphery of this sleeve fit into corresponding grooves in the barrel-casing extension thereby preventing rotation of the barrel. There are two cams on the rear end of the sleeve. On each side of the breechblock head are two rollers, located behind the buttress threads. As the breechblock goes forward, the two inner rollers contact the cams on the cam sleeve causing the breechblock head to rotate clockwise, thereby engaging its buttress threads with those in the cam sleeve and locking the breechblock to the barrel. This operation takes place with the barrel in its fully forward position. Unlocking begins after 3/16-inch recoil, when the two outer rollers on the breechblock contact the two cam surfaces in the front end of the body causing the breechblock head to rotate counterclockwise, thereby unlocking it from the barrel during the remaining 9/16-inch of backward travel. The breechblock carrier is prevented from rotating by means of lateral guide ribs which project into the guide ways in the body of the gun.

On pressing the trigger, the breechblock goes forward when the sear is depressed. A spring-loaded feed piece, on top of the breechblock strikes the base of the cartridge and thrusts it from the belt toward the barrel chamber. At this point, the feed arm, actuated by the groove stud on the top rear end of the breechblock carrier, causes the feed pawl to push the next round toward the breech opening. Continuing forward, the two inner rollers

Foreign Weapons

on the breechblock head contact the two cams on the cam sleeve, rotating the breechblock head clockwise so that the breechblock buttress threads engage those on the cam sleeve and lock the breechblock to the barrel. The extractor meanwhile rides over the cartridge rim. The breechblock carrier continues forward and trips the firing pin catch, thereby allowing the firing pin to go forward to fire the round. The forward movement of the carrier is arrested by the small shoulder on its right front striking the cocking-handle stop which now butts against the

THE GUN "BROKEN" TO CHANGE THE BARREL

front end of the slot in the right side of the body. Meanwhile, the breechblock locking catch has engaged behind the outer roller on the right of the breechblock head.

As the bullet leaves the muzzle, the blast pressure is partially trapped and reacts on the muzzle end of the barrel thereby assisting the recoil, as in the Vickers gun. After 3/16-inch backward travel of the barrel and breechblock, the two outer rollers on the breechblock head contact the two cam surfaces in the front end of the body, causing the breechblock head to rotate anticlockwise and thus unlock the breechblock from the barrel. At the end of the unlocking operation, the backward movement of the barrel is stopped by its cam sleeve coming against shoulders in the front end of the body. At the same time, the feed arm causes the feed pawl slide to move back so that it engages behind the next cartridge in the belt. As the breechblock continues backward with the empty case held by the extractor, the rear end of the ejector pin, which is located on top of the breechblock, strikes the ejector stop. The ejector is thus pushed forward and protrudes through the breechblock face, ejecting the empty case downward through the ejection opening.

A BARREL casing, approximately 1½ inches in external diameter, made of perforated sheet metal, encloses the barrel. Its rear end fits in the barrel-casing extension. Dispersal of heat is by simple radiation. The flash eliminator and blast trap is cone-shaped and is screwed on the muzzle attachment.

Beneath the ejection opening is a dust cover which automatically opens when the trigger is pressed. Since the mechanism of the gun is very sensitive to dirt, this cover should always be kept closed when the gun is not in action, and the gun must be kept scrupulously clean and well oiled to insure proper functioning.

The fore sight blade is fitted in a slot on the fore sight pillar. It is retained there by a small setscrew and is laterally adjustable. The pillar, which can be folded down, has a spring-loaded plunger to retain it in position. The height of the blade above the barrel casing is approximately two inches. The back sight pillar is similar in type. The rear sight is an auxiliary aperture sight which has a leaf spring for the purpose of retaining it in position. This aperture is used with an antiaircraft "cart-wheel type" fore sight which can be fitted on a bracket on the barrel casing about eight inches behind the blade fore sight.

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Illustrated is an operation which gave a typical KENNAMETAL production performance. Floor to floor time on these 90-mm. shells was 1.2 min. per shell. The amount of stock to be removed was 3/32" on the side and 3/16" on diameter. The job was operated at 357 R.P.M., with 325 feet cut per minute and feed per revolution .017".

The three KENNAMETAL tools in front of the operator have a contour job to accomplish. Regular runs of 250 to 400 shells are realized per set of tools between grinds. Seldom are the tools changed more than once in each eight hours of production. All tools used in this operation were KENNAMETAL Grade K3H, the proper grade for a finishing operation of this type, and for this steel which had a hardness of 180 to 190 Brinell.

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New Type Electric Power System Saves Copper

D. L. Beeman

A REVIEW of war-plant electric-power systems has shown that thousands of tons of copper can be saved by employing a new form of electric-power distribution known as "load-center distribution." The function of a distribution system is to transmit power from the source—the plant generation station or the point where power is delivered by the utility—to utilization devices such as motors, welders, electric furnaces, etc. It consists mainly of transformers, cables, and switchgear.

In a typical medium-size factory, 400 feet wide by 750 feet long with a total electrical demand of 3,000 kva, 5 tons of copper are saved by using the load-center method in place of

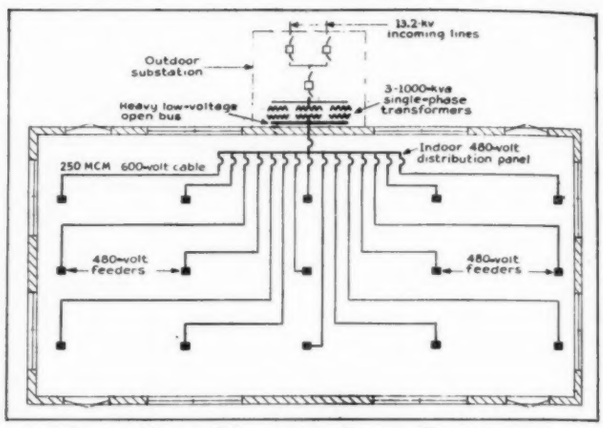

Fig. 1. Usual Method of Power Distribution

the old method of power distribution. A comparison of the two methods will show how these savings are effected. The plant received power from the local utility over two 13,800-volt, 3-phase power lines. The old method of distributing electric power from the utility lines to the motors, etc., for such a plant is shown diagrammatically in Fig. 1. This method includes high-voltage circuit breakers for protecting the large 3,000-kva transformer bank which reduces the voltage from 13,800 volts, as delivered by the utility, to the 480 volts required for the motors and other utilization devices. Connected in the 480-volt circuit is a large switchgear unit consisting of air circuit breakers for control and protection of each 480-volt cable. The power is distributed throughout the plant over heavy 480-volt cable to the local distribution centers or panel boards. There are fifteen panel boards, hence fifteen 480-volt cables in all. Twelve tons of copper are required for the high-voltage breakers, transformers, 480-volt switchgear, and 480-volt cables.

The load-center distribution system which will greatly reduce the quantity of copper required for the same plant is shown in Fig. 2. The high voltage supplied by the utility is terminated at some high-voltage switchgear just as in the old method, but, from here on, the systems are entirely different. In the load-center form, the high-voltage is carried right into the building. Instead of one large transformer bank there are several small transformers for reducing the voltage from 13,800 to 480 volts. These transformers are located at the center of the load area; hence only short 480-volt feeders are required to reach the fifteen panel boards or distribution points.

The load-center system is the equivalent in every way of the old system of power distribution. The same load is served, the

same voltages are used, and the same distribution points are supplied, but the former requires only seven tons of copper compared with twelve tons for the old method. There is no sacrifice in safety or efficiency, and the new system can be installed with a considerable saving in time and cost.

The two fundamental copper-saving principles of load-center distribution are: (1) Electric power is distributed at high voltage (2,400 to 13,800 volts) to substations located near the electrical load centers. There it is reduced to utilization voltage (600 volts or below) and distributed to the loads via short, low-voltage cable runs. (2) Where the load requires it, two or more small substations are used rather than a single large substation.

Load-center distribution saves copper mainly through reducing the low-voltage feeder length by locating the substations at the center of the load and by using several small substations instead of one large one. For example, the copper required for the cable of the long, heavy, low-voltage (480-volt) feeders of the installation shown in Fig. 1 is 13,600 pounds, whereas the copper required for short, low-voltage feeders (Fig. 2) is only 3,420 pounds. The copper required for transformers and switchgear is about the same for both cases.

This may make it appear that the smaller the substation the

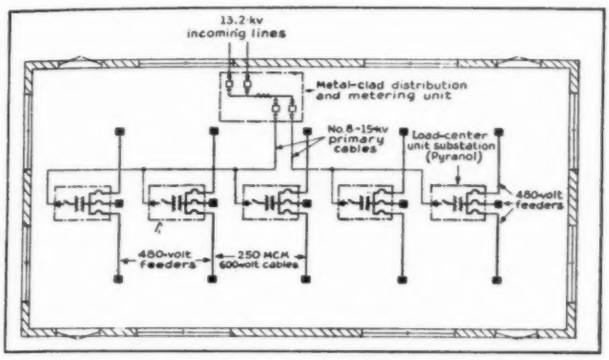

FIG. 2. THE LOAD-CENTER DISTRIBUTION SYSTEM

less the copper required. However, as the substations become smaller and smaller, more primary cable is required, and less efficient use is made of the material employed to construct the small equipment. While there are occasional exceptions, a good rule is that substation ratings higher than 1,000 to 1,500 kva with 480-volt low voltage, or 500 to 750 kva, with 120/208-volt low voltage usually indicate an opportunity to conserve copper by dividing the substations into smaller units. If the rule were always applied when it should be, thousands of tons of copper that could be used for ordnance matériel would be saved.

THE load-center system often necessitates setting the substations right in the working area on the factory floor as shown in Fig. 3. Such locations are permissible as well as safe and practicable for the new factory-assembled enclosed-unit substations without requiring expensive vaults around each substation. Such equipment can usually be located on subbalconies, adjacent to or over washrooms, along building-column centers, and in similar areas of minimum value as working space. In any event, they occupy an area of only one-tenth to perhaps one-half of one per cent of the total floor space of the plant.

There are other ways in which copper can be saved in war-plant electrical systems. One of these is to employ the highest voltage practicable; for example, 480 volts for motor cranes and welders instead of 240 volts or 208/120 volts. It requires a conductor weighing 4.6 pounds per foot to carry 150 kva—an average load—per circuit at 208/120 volts. The same power can be carried by a conductor weighing only 1.2 pounds per foot if 480 volts is used.

Likewise, if 13,800 volts or 4,160 volts is used for high-voltage

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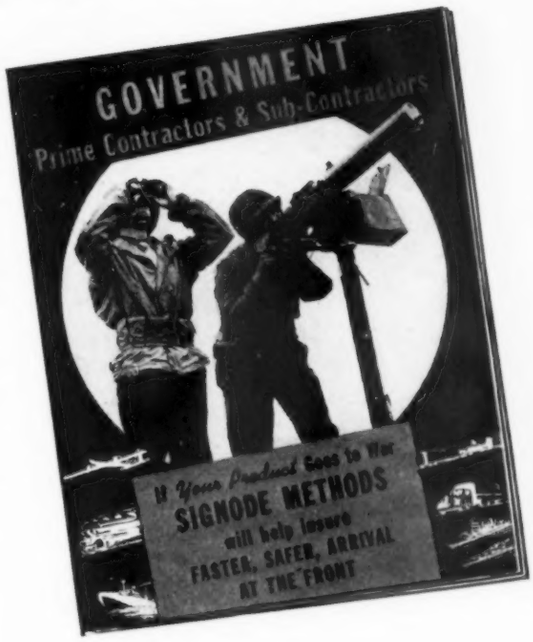

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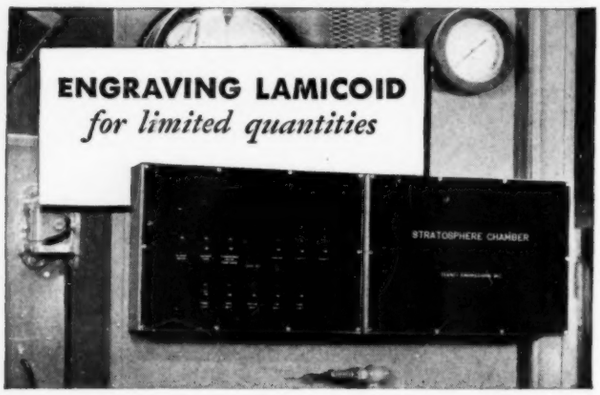

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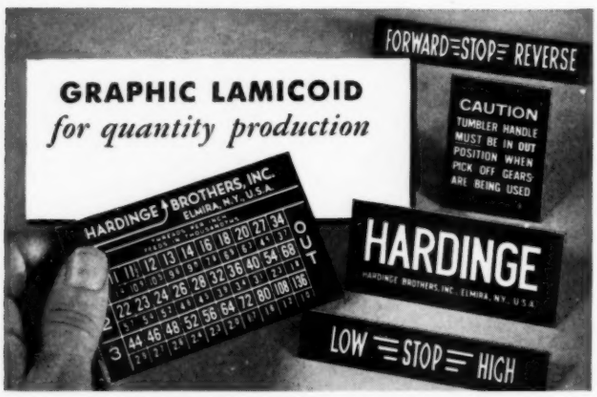

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circuits instead of 2,400 volts, sizable quantities of copper can be saved in many installations. For example, in one large aircraft plant, over 65,000 pounds of copper were saved by carrying power at 13,800 (instead of 4,160) volts from the utility's substation supplying the plant to load-center substations where it was stepped down to 480 volts for utilization. The large substations which supply the distribution systems in industrial plants are as fertile a field for saving copper as the industrial plants themselves. These large outdoor substations are used for switching and for transforming large blocks of power from trans-

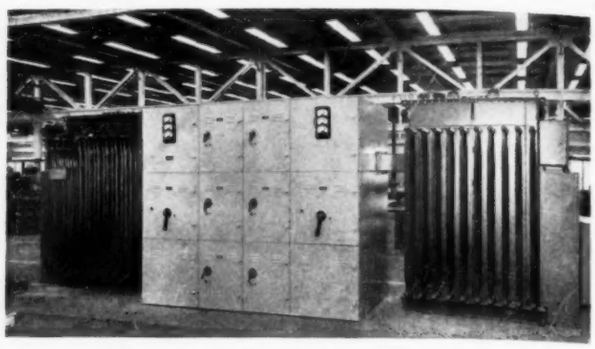

FIG. 3. AN INDOOR UNIT SUBSTATION

mission voltages (22 kv and above), to primary distribution voltages (between 2,400 and 13,800 volts).

The two elements of these stations wherein copper can be saved are the switchgear for the 2,400- to 138,000-volt circuits and the transformers. Factory-assembled metal-enclosed switchgear equipment requires, in general, substantially less copper than field-assembled piecemeal types. Metal-enclosed equipment is considerably smaller, hence the copper circuits within the switchgear are much shorter than in the piecemeal type.

The use of auxiliary cooling equipment in the form of forced air on medium-sized banks of transformers and forced oil in combination with forced air or water cooling on large transformers results in substantial material savings. As an example, the copper required for a 30,000-kva, 13,800-volt, 3-phase transformer is reduced 23 per cent and the steel 28 per cent by the use of forced-oil circulation in combination with forced-air coolers. The copper savings mentioned for both transformers and switchgear are obtained when modern unit substations are applied.

While it has nothing to do with the layout of the electrical system or the selection of the type of apparatus, much copper can be wasted by overestimating loads. Where a new plant is to be built similar to one that already exists, data on electrical loads of the existing plant should be obtained before estimating the electrical demands for the new plant. This will be helpful in assuring that the new plant is equipped with an electrical system that is adequate and not wasteful of copper which could be used more directly in the war effort for ordnance matériel.

CONSERVING TOOL STEELS

THE tremendous amount of work already accomplished to conserve high-speed steel is not enough to prevent our limited stocks from being depleted. A single airplane motor requires about $150 worth of expendable tooling per thousand horsepower; hence it is easy to foresee the astronomical size that our future small-tool requirements will reach. It is necessary that every industrial, commercial, and domestic user of steel tools devise ways and means of conserving what he has before our limited national supply is gone. The typical ways and means of

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conserving small tools outlined below are but a few of the ideas expressed by speakers at the war production conference of the American Society of Tool Engineers, held at Springfield, Mass.

Materials for metal-cutting tools: (1) Whether to use an alloy or not now depends upon the specific end use. The best alloy steel should not be used when the lowest grade will do the job just as well. (2) The critical need for high-speed steel is shown by the fact that four new basic steels were devised to serve the same purpose and give about the same physical properties as all the other S.A.E. steels formerly used. However, this was not enough, so three new basic steels were devised, using even less alloy. (3) It is becoming vitally necessary to use cemented-carbide-tipped tools to conserve high-speed steel. The ratio of efficiency of the carbides over high-speed steel is ten to one. The carbides are good for machining copper, using a lot of speed, plenty of rake, and sour milk as a lubricant. (4) Solid carbide rotary files on aluminum have an efficiency over high-speed steel of one hundred to one; the cost is nowhere in that proportion.

Conservation: (1) It pays to keep cutting tools reasonably sharp. The squeal of, and the shiny machined surface caused by, a carbide tool may be the signal that it is about to break. High-speed steel produces a warning smoke and a rough finish when dull. Speed may not work on forming tools unless they are narrow. (2) The number of parts produced per grind may often be increased many times by such tool treatments as nitriding and chrome plating, which reduce friction. A new successful chrome-plating process is available on a royalty-free basis. (3) The design of a tool may be improved to reduce breakage. Care should be taken to see that tool stubs are either salvaged or returned to the mill as scrap. Broken tools may often be removed successfully by welding a rod to the broken tool stub, thus saving costly work in process.

Substitution: (1) Glass has been used successfully to replace steel for many types of gages. Complete information and techniques for properly working glass will soon be available. (2) Piston reamers have been made successfully of steel blades inserted in a steel core and encased in a plastic body. The reamer contains only about eight per cent steel. (3) A high-speed steel cutter welded to a low-carbon steel shank may also help conserve tool steel. (4) The use of a collet, instead of either a heavy screw-on shank or a heavy taper shank, may save a lot of high-speed steel. It may be practicable to make the shanks of carbon steel. (5) An available cutter of a different size may do the job just as well as the one specified.

Glass Precision Gages

PLANS for large-scale substitution of glass for steel in the manufacture of precision gages used to inspect war matériel are now under way. At least half of the hundreds of thousands of steel gages now in use by manufacturers and inspectors of ordnance items can be replaced by glass gages. Glass gages, no longer in the experimental stage, are now in use at Frankford Arsenal.

Saving of three-quarters of the man-hours of machine-tool labor required for the manufacture of steel precision gages, as well as significant quantities of critical alloy tool steel, will be obtained by use of glass gages. The cost of these gages is only half that of steel ones, once the molds for the glass instruments are made. Visibility in inspection, not always possible with steel, will tend to produce a superior product. Perspiration on the hands of inspectors has no corrosive effect on the glass gage as it has on steel. Moreover, the thermal conductivity of glass is less than that of steel, and heat transferred from the hands of inspectors to the gage will not affect gaging dimensions.

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rust involved. Glass appears to have abrasive-resisting qualities equal to or better than steel in many gaging applications. Where the component part of the machine is very near the size of the gage, there is less tendency for the component to seize or gall on the glass than on the steel gage. Scratches on glass do not leave a burr and do not change the effective size of the gage.

More Tremendous Trifles

THE campaign to save time, materials, and money by the redesign of ordnance components and the substitution of materials is gaining momentum in the nation's war industry as more and more items are redesigned and show the truly tremendous savings possible. The Ordnance districts are taking a prominent part in this campaign by encouraging and assisting the war

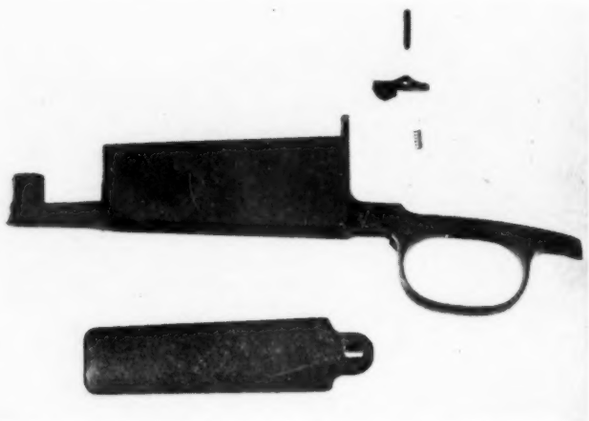

FIG. 4. TRIGGER-GUARD ASSEMBLY BEFORE REDESIGN

production facilities in their respective areas to investigate the possibilities of new designs and methods to save materials.

In the Rochester District, for example, practically every component for the Model 1903 rifle has been redesigned by the Remington Arms Company, Ilion, N. Y., in order to simplify the method of manufacture, to increase production from the available machine tools and labor, and to conserve raw materials. The redesign ranged from minor changes to the complete redesign of parts to the extent that even the shape of the parts was altered. The result of this work is the U. S. rifle, caliber .30, M1903A3.

In consequence of the changes made on the rifle and accessories,

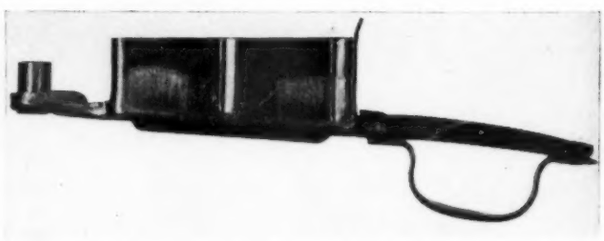

FIG. 5. REDESIGNED ASSEMBLY FOR THE 1903 RIFLE

6.4 pounds of raw steel and approximately 1 pound of brass are saved on each weapon. Production is being increased about 300 per cent at the Remington plant, but approximately 1,300 fewer machine tools are required than would be necessary for manufacturing the previous design, and about 20 man-hours are saved on each rifle. Approximately twenty per cent of the work can now be subcontracted to sheet-metal fabricators who have considerable free capacity.

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As a result of these changes, the cost of the rifle has been reduced twenty-five per cent. Nearly ninety per cent of all the redesigned components are now in production and are working satisfactorily. Experience has shown that if the rate of production is reasonably high, it is worth while to redesign a component for manufacture from sheet metal rather than from a forging even though this requires complete retooling. The more sheet metal components are used, the less difficult it is to procure the necessary steel and tools. Also, as no cutting tools are required for the sheet-metal components, the problem of obtaining such tools is completely eliminated.

For example, blanked and formed parts replaced forgings in each of the following components of the 1903 rifle: *Butt swivel,* with a saving of 0.06-pound of steel and 9 cents in direct labor on each rifle; *extractor collar,* saving 0.10-pound of steel and 8 cents in labor; *follower assembly,* saving 0.15-pound of steel and 14 cents in labor; *butt-plate assembly,* with a saving of 0.25-pound of steel and 38 cents in labor costs; *upper-band and stacking-swivel assembly,* a change which saved 0.87-pound of steel and 56 cents in labor; *middle-band assembly,* saving 0.22-pound of steel and 25 cents in labor costs; *trigger-guard assembly,* which effected a saving of as much as 2.72 pounds of steel and $1.16 in labor costs on each rifle (Figs. 4 and 5). A coined wire part replaced a forging in the middle-band spring with a saving of 0.04-pound of steel and 7 cents in direct labor.

FIG. 6. THE 155-MM. SHELL-LIFTING PLUG BEFORE AND AFTER REDESIGN

The conversion engineering section of the Birmingham Ordnance District also is beginning to see tangible returns from its drive to unearth ways and means to conserve strategic materials. To date, at least three items have undergone changes resulting in tremendous savings in man-hours, money, and metal.

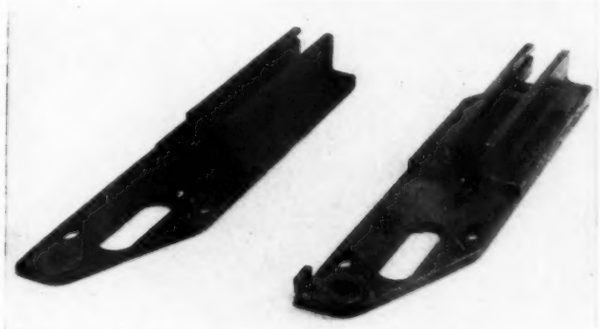

FIG. 7. TRIGGER CONTROL BODY FOR THE CAL. .50 A.A. MACHINE GUN BEFORE AND AFTER REDESIGN

A suggested change, so simple as to be almost unbelievable, was the coring of a small hole in the base of the 155-mm. shell-lifting plug, which not only saves 312 tons of metal per million plugs and 20 tons of metal a month in the Birmingham District alone, but eliminates shrinks from the casting.

Figure 6 shows the steel plug on the left as it was formerly forged, weighing 1.75 pounds. On the right is shown the plug

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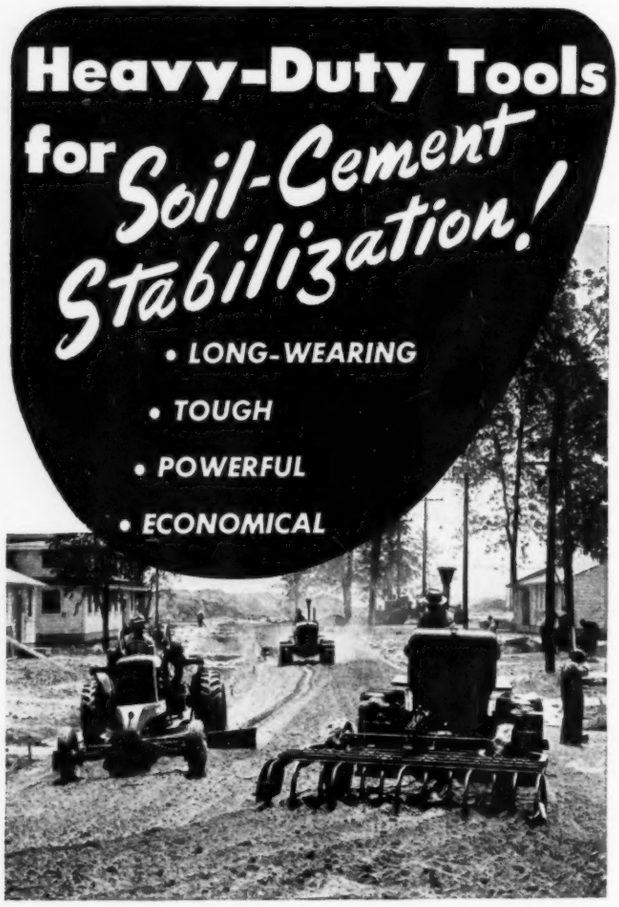

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after the changes had been made, resulting in a saving of 0.625-pound per plug. The sectioned plug in the center shows how the new design results in a uniform section throughout, thus making a sound, stronger casting.

A similar saving was obtained in a booster body, by the simple expedient of changing from brass rod or brass casting to malleable iron which effected a saving of 0.59-pound of brass per booster and 295 tons per million booster bodies.

Because an ingenious inspector believed that a small strip of metal could be removed from the bottom of a fin crate and a section be formed in the base of the crate to act as a guide, 276 tons of steel are being saved on the remainder of the crates under contract in the Birmingham District. Two strips of metal on the inside of the bottom of the packing crate were eliminated by forming a raised section by altering the dies already in use. The blanking of these raised sections did not increase the operations for this was performed at the same time as another dieing operation. In addition to savings of 0.32-pound on each crate and 162 tons on a million crates, 8 spot welds per crate were eliminated as well as the labor required to cut out the pieces formerly used.

In the Cleveland Ordnance District, likewise, many components of ordnance matériel have been redesigned with similar savings in time, materials, and money. Figure 7 shows the trigger control body of the cal. .50 antiaircraft machine gun. The original control body, on the left in the illustration, was made from a machined forging requiring 3.57 pounds of steel and 150 minutes of machining time at a cost of $6.50. The redesigned body, shown at the right, is made from a brazed stamping requiring 2.07 pounds of steel and 15 minutes' machining time at a cost of only $1.75. The resulting savings on thousands of machine guns will indeed be tremendous, but they will be no "trifles."

New All-Wood Army Transport

THE first military transport plane of the present war to be built almost entirely of wood and other nonstrategic materials is nearing completion in a plant of the airplane division of Curtiss-Wright Corporation "somewhere in Missouri" and will shortly undergo flight tests. Other transports of the same type already are in production.

The new "air freighter," named the Curtiss Caravan (C-76),

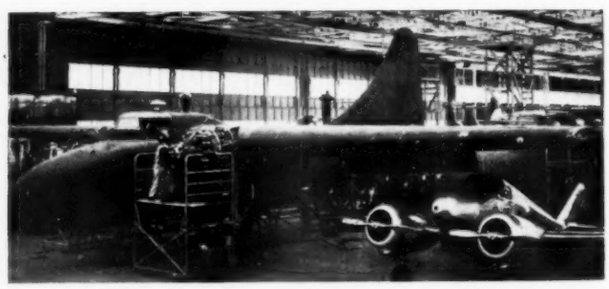

Fig. 8. The New Curtiss Caravan Army Transport

This air freighter has a wing span of 108 feet, is 68 feet long, and is powered with two 1,200-horsepower engines. The AT-9 advanced trainer beneath the wing of the Caravan indicates its huge size.

was designed by Curtiss-Wright engineers to be built of wood and to be used by the U. S. Army Air Forces in transporting troops and vital cargo over the rapidly expanding supply routes extending to widely scattered battle fronts. The first American military cargo plane to be designed in the present war, it is the second transport type to be put into production this year by Curtiss-Wright Corporation, the other being the all-metal Curtiss Commando (C-46)—the world's largest twin-engined plane.

The Caravan (Fig. 8) is basically an all-wood airplane combining molded plywood, laminates, and plain lumber. Every

Professional Digest

wood-fabricating process contributing to rapid production is being employed. Since sixty-five per cent of the production of this type is subcontracted to the wood industry—a source of labor, machinery, and skill not closely identified with the war effort until recent months—its construction has a minimum effect on existing aircraft production.

The new, giant air freighter is a high-wing monoplane, has a wing span of 103 feet (approximately that of the giant Commando), is 68 feet long, and is powered with two 1,200-horsepower engines. It is equipped with landing gear of the retractable tricycle type assuring maximum maneuverability on small landing fields and is built so that its cargo floor is only 36 inches from the ground, thus facilitating rapid loading and unloading of cargo.

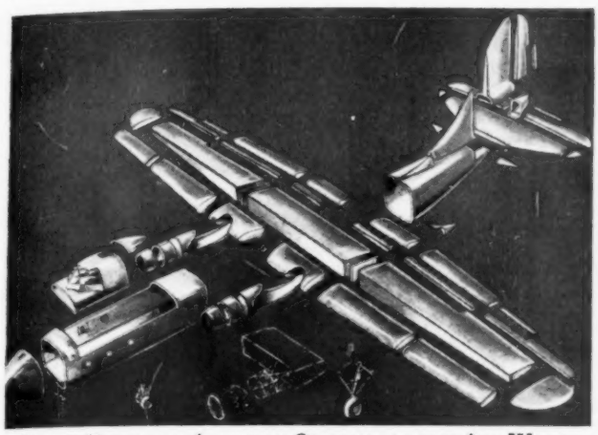

FIG. 9. PRINCIPAL ASSEMBLY SECTIONS OF THE ALL-WOOD AIR FREIGHTER

The control compartment of the Caravan is situated above the forward section of the cargo space and accommodates a crew of pilot and copilot but offers provisions for including a radio operator when desired. The cargo section will accommodate any component part of a plane except the fuselage.

The plane is said to possess maximum efficiency as a low-stalling-speed plane for transporting paratroops, air-borne task forces, field artillery, and other military cargo over short runs of from 600 to 700 miles with frequent stops. The German air forces used JU-52's as cargo planes in the battle of Crete, "mushing" them through treetops and deliberately sacrificing them in order to deliver urgently needed supplies to ground forces without delay. It is claimed that the new Caravan can be landed in such an emergency with the prospects of being damaged less than cargo-plane types possessing higher speeds.

While the first Caravans are being built in a Missouri plant, their quantity production will actually get under way shortly in a newly erected factory "somewhere in Kentucky" where a system of feeding subassemblies (Fig. 9) into a main assembly channel will be followed. Coöperating in this production program are three major subcontractors—the Mengel Company of Kentucky, the Baldwin Piano Company of Ohio, and the Universal Moulded Products Company of Virginia.

Woods used in the production of the Caravan are hickory, spruce, birch, gum, mahogany, and Douglas fir. The plywood ranges from 3-ply used in the construction of the leading skin edges, to 9-ply employed in the center panel. The wings are of the conventional 2-spar, box-type construction while the wing spars are of laminated spruce cap strips, with plywood webs, internal diaphragms and stiffeners. The fuselage is of semi-monocoque construction. Andrew J. Higgins, New Orleans shipbuilder, recently has secured a contract to construct a large number of planes of this type for the Army Air Forces. The total outlay will involve more than $5,000,000.

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Book Reviews

THE COMING BATTLE OF GERMANY. By William B. Zeff. New York: Duell, Sloan & Pearce, Inc. 280 pp. $2.50.

THE title page of this thought-provoking volume is followed by one bearing only the following quotation: "Pour les vaincre, Messieurs, il faut de l'audace, encore de l'audace, toujours de l'audace" (Danton—speech to the Legislative Committee of General Defense, Paris, September 2, 1792). Perusal of Mr. Zeff's book reveals his war cry to be: "Le pouvoir aérien, encore le pouvoir aérien, toujours le pouvoir aérien!" For, as Maj. Lester D. Gardner has observed in *The Aëronautical Engineering Review*, "he aligns himself with Douhet, Trenchard, Mitchell, Williams, and De Seversky in his advocacy of air power." Yet sober analysis of the text convinces one that the author's program is extremely well thought out and by no means to be dismissed by the airy wave of an academic hand. Perhaps the worst accusation that may be brought against it is that it counsels the segregation of all our eggs in a single basket via the mass production and mass employment of one type of weapon at the expense of all others. And while those learned in the art of warfare can point to myriad instances in which such a maneuver has resulted in disaster, there are enough examples on record, brilliantly exceptional, to prove the rule.

Mr. Neff's is an exceptional book, embodying numerous observations trenchant in their simple truth. "A single airplane can do a better reconnaissance job in fifteen minutes than all of Stonewall Jackson's cavalry in a day of reconnoitering. . . . While all other instruments of war have more or less reached their peak in efficiency, the airplane is in the very beginning of its development. . . . Without absolute air control over the area of attack, the entire tank assault collapses. If the defending artillery remains intact, neither *Panzers* nor motor-borne infantry may approach. . . . Aircraft cannon already enable planes to cope with light tanks and soon may be expected to carry heavy enough guns to make tanks of every type as vulnerable as cheeseboxes. . . . The Germans got ready for war so early . . . that by the time it came, many of their aircraft were obsolescent and some even obsolete." And finally: "Air power must be recognized as the single weapon by which domination may be achieved (by the U. S. over Germany in World War II) and all tactics should be directly designed around it. . . . The entire machinery of procurement and combat as it relates to air should be thrown into one, with direct representation in the President's cabinet."

To those who agree with Mr. Zeff, his work supplies potent ammunition to support their theories. To those who do not, it offers many startling conclusions the logic of which will be difficult to refute. C. G.

A LAYMAN'S GUIDE TO NAVAL STRATEGY. By Bernard Brodie. Princeton: Princeton University Press. 291 pp. $2.50.

AT a time when long-range bombers and carrier-based torpedo planes have modified naval tactics, there is a tendency to believe that all surface vessels are obsolete. The Coral Sea and Midway battles were fought without the surface fleets ever coming within gun range, and aircraft alone decided the issue. Too hasty judgment is prone to proclaim that the day of the surface vessel—particularly the battleship—is past and that air power will insure command of the sea lanes.

Mr. Brodie is not carried away by the claims of air-minded extremists. He contends that a balanced fleet, including aircraft carriers, is indispensable to ultimate victory in our present global struggle. The backbone of such a fleet is still the battleship.

Control of the seas is the first essential for the support of our far-flung armies, and this can only be achieved by surface vessels —humble merchant ships protected by warships. Even the airplanes would have a hard time getting at the enemy if most of them, their fuel, and their ground personnel were not carried in ships.

The publication of this book comes at an opportune time when the newspaper headlines almost daily feature sea actions in all parts of the world. It is indeed a layman's guide which explains in simple terms the tools of sea power, the principles of command of the sea, the defense of shipping, combined land and sea operations, the characteristics of naval bases, the tactics of fleet actions, and a fine exposition of the importance of the men behind the guns.

Perhaps the greatest value of Mr. Brodie's present work is that he has digested the many new factors in their relation to simple principles of naval strategy affecting the current struggle for sea power and has interpreted them in such a manner as to be easily understood by the layman. It is to be hoped that he will continue to add to the material already accumulated as the war progresses and finally write a manual which will be just as useful to the naval officer as to the civilian. E. E. M.

FIELD ARTILLERY GUIDE. Prepared by the *Field Artillery Journal*. Washington: U. S. Field Artillery Association. 910 pp.

THIS book is a guide for use by artillerymen as a reference in the field. Although 910 pages in length, the volume is concise and well designed with flexible covers and may be carried readily either in the pocket or a musette bag. Officers and enlisted men of the Field Artillery will find most of the essential working data necessary for the performance of their job in the guide, with the exception of hippology.

Presented in a manner similar to that employed in engineering textbooks, both a subject index and an alphabetical index are included. The subject matter is divided into three main topics: Firing, Tactics and Technique, and Reference Data. The section on firing is subdivided into five chapters dealing with artillery matters exclusively, plus one chapter on topography and surveying. Part II is general in character and reviews the subjects of reconnaissance, camouflage and field fortifications, command and staff functions, tactical employment, artillery with armored divisions, signal communication, defense against chemical attack, motor transport, shelter, and logistics. The chapter on motor transport is exceptionally well written and comprehensive. Many helpful forms for records and reports relating to every phase of field artillery are included in the reference-data section. This publication also may be used to advantage by ground-force personnel of arms other than field artillery, such as Armored Force and tank-destroyer troops. B. B. A.

THE SELF-BETRAYED. By Curt Riess. New York: G. P. Putnam's Sons. $3.

FOR one hundred and fifty years, the chief influence on German affairs, and in fact, on world affairs, has been a military caste stemming from less than three hundred families in "Ostelbien," that part of Prussia lying east of the Elbe River. It is from these families that German generals have come for generations. Mr. Riess calls them "The Generals"—very special generals because they have always differed in their aims from generals in other countries. Direct political power has had no attraction whatever for them. They have never concerned themselves about the ends for which the wars of Germany have been fought since the days of Frederick the Great. Strangely enough, they have not even considered themselves the servants of the state nor of the people. Forms of government change, and the people exist merely to produce soldiers for them to lead. War is the normal state of affairs with intervals of peace to get ready for the next war. The pursuit of glory has always been a dominant passion, leaving little room for the pursuit of happiness.

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Little wonder that a strange people developed from this hard philosophy of life—shadowy figures whose love for war has kept the world in a turmoil for a century.

Mr. Riess epitomizes his book as "the story of the tragedy's last act." Beginning with January 1938, the consolidation of Hitler's power and the submergence of "The Generals" is skillfully described against the background of events. This last act of the tragedy is really a well-written history of Germany to the middle of 1942. Its climax is Hitler's assumption of command in the war with Russia and his decision for a winter drive against the advice of "The Generals" who knew their Napoleonic campaigns well enough to insist that disaster only could be expected. They were right, but the dictator was now in a position to have his way.

Throughout the book, the author piles up evidence of the decline of the German military caste. He wonders whether the caste will, in spite of odds against success, risk a revolution against Hitler in the hope of saving themselves, but concludes that even a successful revolution unseating Hitler would nevertheless mean the end of the military caste at the hands of the long-suffering German people. E. E. M.

Behind Both Lines. By Harold Denny. New York: The Viking Press. 209 pp. $2.50.

THE author was captured by Rommel's men in Libya and turned over to the Italians for imprisonment. As an accredited correspondent for the *New York Times*, he was a civilian, but this was not recognized, and he suffered all the experiences of the military prisoner. He was moved to Italy, then turned over to the Germans and taken to Berlin as a prisoner of the Gestapo. He was returned to the Italian internment camp for British prisoners at Poppi and finally returned to the United States on the Drottningholm. He was the last American to be inside Germany after Pearl Harbor, which makes his account of the period spent in the hands of the Gestapo in Berlin most interesting.

This book is definitely not a horror story. It describes calmly and clearly the psychological and physiological aspects of imprisonment in an interesting and matter-of-fact manner. It invokes sympathy for the Italian and German peoples and for individual soldiers and officers, while placing the blame on their self-appointed leaders. The clear descriptions of the prisons and their facilities, the reduced rations and supplies of the civilian populace, and the intimate details of daily prison life are entertaining and informative. The best of the war-correspondents' books so far received. T. K. V.

Soviet Asia. By Raymond A. Davies and Andrew J. Steiger. New York: The Dial Press. $3.

INDUSTRIAL planning untrammeled by precedent is the marvel that has come out of Soviet Asia. Always throughout the industrial age, the dreams of technicians, builders, and architects, have been hampered and stilted by cold precedents, prejudices, and financial limitations. But Soviet Asia knew no such limitations; works and cities grew around the mines and selected strategic points; vast highway systems stretched out to link up these centers. The dreams of producing rubber from dandelion roots or goldenrod stems became realities when men were given the facilities to go ahead. From the deepest parts of a continent where for untold ages men had been limited to tending flocks, enthusiastic youths were brought to Moscow and Leningrad to learn the fundamentals of the scientific age and sent back to teach them to their people. Such is the magic that is unfolded in the intimate stories the authors weave around the opening of the mines, the transformation of a populace.

Perhaps the authors are somewhat overenthusiastic, but this reviewer is inclined to believe that the fundamentals they state

Book Reviews

are correct. It was not the principles of Communism that built the new Russia, but the enthusiasm of a people and the opportunity to express that enthusiasm without the hampering bureaucracy of old precedents. This reviewer believes that the war has already brought the Russian people back to a realization of the values of certain moral principles antagonistic to the Communistic theories and that a new Russia will take its place among the nations of the world. During the depression it was said that the difference between Communism and Democracy was merely nine square meals. Russia has been preparing itself to get those nine meals for its people. If this is so, it may easily rival America in mechanical achievement because it has no set rules or worn-out business methods to hamper it. Every American who wants to know something of what Russia has so far accomplished industrially along this line will find good reading in this book. G. S. B.

MAKE THIS THE LAST WAR. By Michael Straight. New York: Harcourt, Brace and Company. 417 pp. $3.

THIS is an ambitious work which attempts to cover many of the basic political, economic, and other questions which are now perplexing statesmen and which will continue to do so in the postwar era. An author who in the compass of three pages can state (among other inexactitudes) that the 75-mm. gun in the General Lee tank is incapable of throwing (*sic*) armor-piercing ammunition; that, after they had created (*sic*) the General Grant tank, the British then persuaded the Canadians to bring out the Ram and that it then became possible for them (the British, *sic*) to design the Sherman; that the Americans did not know how to bake (*sic*) a steel turret; and that the Sherman is armed with a British 75-mm. gun, cannot be convicted of undue care in verifying his data. The book appears to this reviewer to be properly classified as a "quickie." R. H. S.

THE MAN WHO DARED TO CARE. By Mary Tarver Carroll. New York: Longmans, Green and Company. 216 pp. $2.

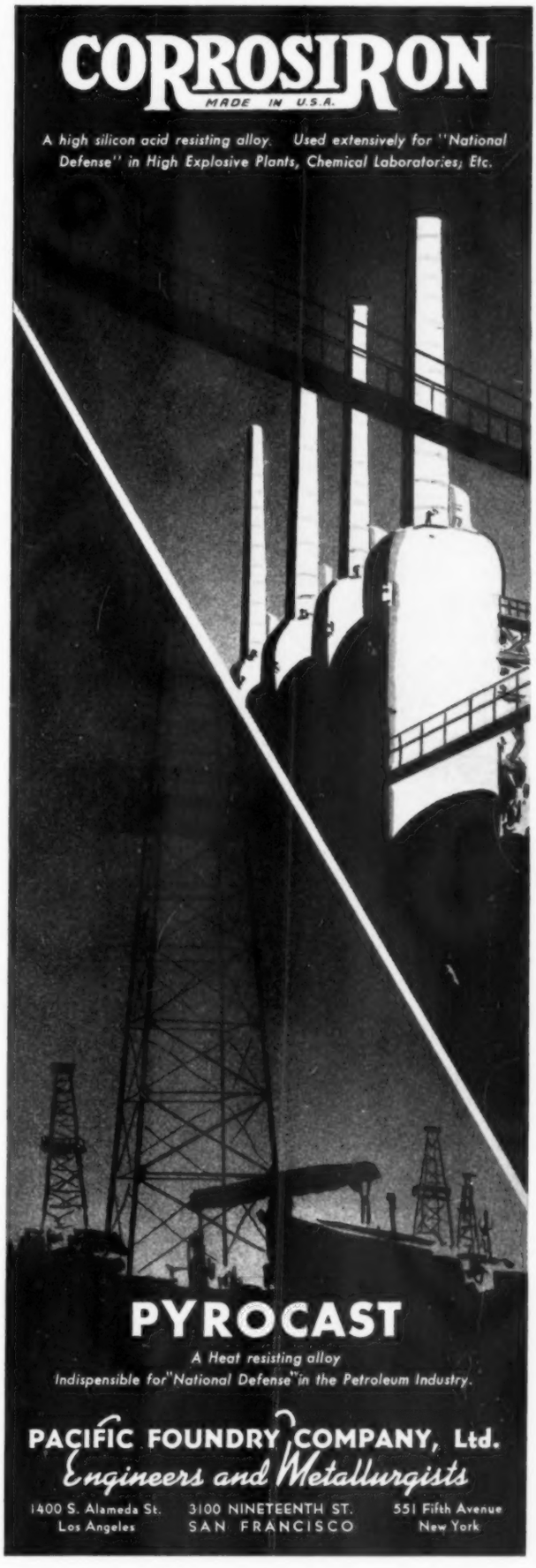
THIS is the story of James Oglethorpe, born to wealth and ease of living, who dedicated his life to the cause of the less fortunate. Following his election to the British Parliament in March 1722, Oglethorpe was appointed a member of a committee to inquire "into the state of the gaols of this Kingdom." From this investigation proceeded the events leading to the foundation of the colony of Georgia—which proved to be as important in the life of America as in that of James Oglethorpe.

The book continues with the adventures of this colony and General Oglethorpe's persevering efforts to convince a distant and not always sympathetic Parliament that Georgia was a vital part of the British Empire as well as one of His Majesty's important colonies in America.

"The Man Who Dared To Care" is simply written in almost storybook form and thus furnishes easy reading for those interested in the remarkable hero of the book but who have little time or inclination for deep research. The American, and especially the Georgian, finds he has a still greater pride in his country because of stories like this. J. C. D.

THE ARTICLES OF WAR ANNOTATED. By Col. Lee S. Tillotson, U. S. Army, Ret. Harrisburg: The Military Service Publishing Company. $2.50.

THIS book will be invaluable to the many officers now in the service whose experience with military discipline and court-martial practice has been limited. Its publication at the present juncture is most timely but it is by no means a "quickie" gotten out to meet an emergent demand. Colonel Tillotson has had large experience both as a civilian practitioner of law and as an officer of the Judge Advocate General's Department of the Regular Army, having held an active commission in that department from 1927 to 1938. The present work was planned by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Book Reviews

Colonel Tillotson years before the beginning of the present war. The text consists of the Articles of War, each of which is immediately followed by annotations covering practice and precedent pertinent to it. These include revisions in accordance with the 1942 edition of the "Digest of Opinions of the Judge Advocate General." R. H. S.

THE FUTURE OF INDUSTRIAL MAN. By Peter F. Drucker. New York: John Day Company. 298 pp. $2.50.

MR. DRUCKER has written a thought-provoking volume which merits the attention of every one interested in attempting to foresee the social changes bound to take place with the end of the current conflict. Obviously, such changes are already taking place and in increasing numbers and magnitude. Will they become fixed after the end of the war, or will they then commence to multiply in number and significance? Will the forces of conservatism attempt, and succeed, in restoring in a measure the social structure which existed during what Mr. Drucker terms "the long armistice" (1919-1939)?

The author divides modern history into three periods—agricultural, mercantile, and industrial. The eighteenth century is the end of the first; the nineteenth century witnesses the rise and fall of the second; and the twentieth is to record the full fruition of the last. How are we to establish a working *industrial* society? This is a problem which Mr. Drucker undertakes to solve, and we can best outline his solution by the following quotation from his volume:

"The central fact in the social crisis of our time is that the industrial plant has become the basic social unit but that it is not yet a social institution. Power in and over the plant is the basis of social rule and power in an industrial world. Centralized, bureaucratic government has almost succeeded in taking away this power from its former holders, the corporation managers. It is a process comparable in many respects to the breaking of the power of the local barons by the centralized bureaucratic governments of sixteenth- and seventeenth-century Europe. And like the barons, the corporation managers are unable to resist.

"But freedom could not be maintained if the centralized government should retain the social power; the best that could be hoped for would be an 'enlightened' despotism. On the other hand, society could not function if the old managerial rule were restored—provided that such a restoration were at all possible. The only solution which makes possible both a free and a functioning society is the development of the plant into a self-governing community. Industrial society can function only if the plant gives social status and function to its members. And only if the power in the plant is based on the responsibility and decision of the members can industrial society be free. The answer today is neither total planning nor the restoration of nineteenth-century *laissez faire*, but the organization of industry on the basis of local and decentralized self-government. And the time to start this is now, when workers and management, producers and consumers, are united in the one purpose of winning the war."

This is a profound work by a student of unquestioned ability. While beautifully written and concisely expressed it is not a volume to be undertaken as a matter of recreation. The seeker after light on human relations will revel in it; he who finds relaxation in "who-done-it" yarns had best pass it by. C. G.

BEHIND THE FACE OF JAPAN. By Upton Close. New York: D. Appleton-Century Company. 417 pp. $4.

IT is axiomatic in war that you must know your enemy. Upton Close tried to introduce us to one of our present enemies as long ago as 1934. The trouble was that no one would believe him, except, perhaps, such realists as Mr. Grew, and he was promptly condemned as a "warmonger." It is most opportune that the 1934 edition of "Behind the Face of Japan" has been dusted off

Book Reviews

and brought up to date to reveal what confronts us in our struggle with a savage and fanatical foe. The feeling is inescapable after reading this book that no compromise peace can ever be made until Japan is utterly and completely crushed.

How an upstart nation in Asia borrowed the tools and weapons of the West, and in the relatively short period since 1867 mastered their use so effectively that fanatical militarists imbued with a "divine mission" were able to make a good beginning in 1942 toward realizing the nation's objectives is Mr. Close's theme. In 1934, Suetsugu, then commander of the fleet, established navy control over Japan's international policy. He did this by presenting a memorial to the Emperor over the heads of the navy minister and privy council, signed by sixty commanders of war vessels, demanding a government which would stand by the navy in its ratio controversy with Britain and the United States. The interesting part is that the cabinet fell and an admiral became the head of the new cabinet. This fire-eater, Suetsugu, remained commander of the fleet until he was ready to strike in 1941, retiring then in favor of his aide, Isoroku Yamamoto, present commander of the fleet, who had been groomed to become the Togo of Japan's greatest naval war.

The author observes that it would have been better if the American public had read about Japan ten years ago, and he contends that we still need to know about Japan. Certainly, his book should be required reading for American officers who may find themselves pitted against this well-trained and savage enemy in any one of many places in the Pacific area where it will be necessary to wage a fight to annihilation. E. E. M.

FIREARMS AND THEIR USE. By W. T. Castles and V. F. Kimball. Brooklyn: Chemical Publishing Company. 231 pp. $1.98.

THIS little volume is essentially a compendium of information available in the current catalogues of American makers of small arms and ammunition. To the data so assembled has been added material on the care of weapons, how to shoot the shotgun, rifle, and pistol, and safety in shooting. The final chapter, which covers a scant three pages, gives a short description of the National Rifle Association and the U. S. Revolver Association. Four and one-quarter pages of references follow this. These constitute a bibliography embracing most of the works published in English on small arms and ammunition during the past 40-odd years. The list is so complete that one questions whether the authors have consulted all the volumes enumerated or merely gathered together the titles of available publications.

This work is distinctly one for the beginner, although the extensive list of references would be helpful to the experienced student of small arms. It is thoroughly readable and can be recommended for perusal by the tyro. While free from glaring errors and omissions, careful scrutiny reveals a number of lesser slips. *Per contra,* the authors are to be commended for their accurate spelling of the word "deringer," so commonly and so erroneously written "derringer" by persons ignorant of the derivation of that term. C. G.

HANDBOOKS AND MANUALS

Oil Plant Protection against Aërial Bombardment. By F. Aldinger.

This is a mimeographed manual containing current practical and technical data on the effects of air raids upon oil-plant installations and methods of effecting protection for such plants against bombardment. The subject matter is well arranged in that it introduces the reader to the practical experience of the British concerning the results of aërial attack and to the type of bombs now generally in use and their effectiveness. The writer refers to the use of demolition bombs and general-

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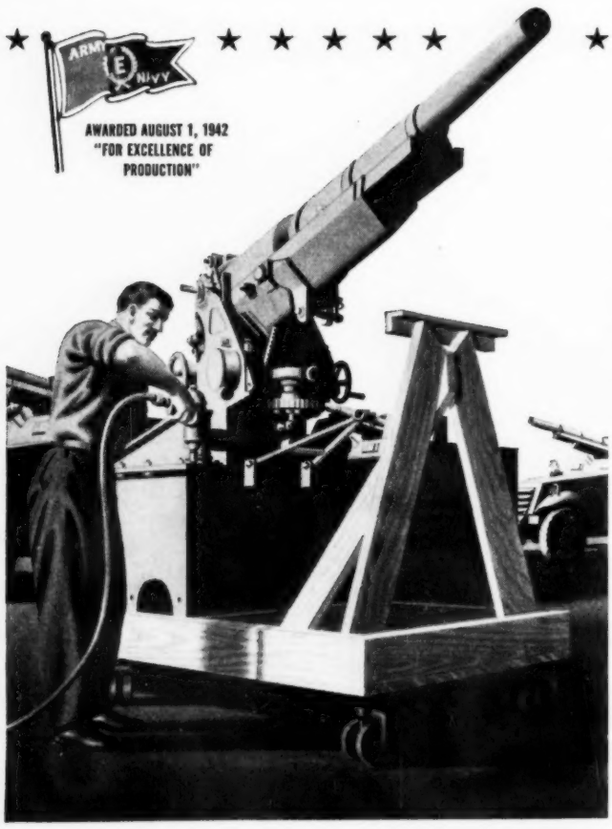

Book Reviews

purpose bombs as two separate types. These terms are used synonymously in this country and the bombs' use determined by setting the fuzes for either instantaneous or delayed action.

The author's recommendation on the use of water to extinguish incendiary bombs is antequated. Recent research work indicates that solid streams of water should be used in extinguishing incendiary bombs in all cases except where considerable loose or inflammable material is adjacent to the burning bomb. The recommended protection of storage tanks, manifolds, pipe lines, and plants appears to be in keeping with the accepted practices. The manual contains a comprehensive section on camouflage. Information on personnel protection, bomb shelters, protection against war chemicals, and black-out is furnished in the appendix which concludes the manual. R. I. G.

Easy Malay. By Marius A. Mendlesen. New York: The John Day Company. 64 pp. $1.

This is a small handbook intended to give the user a vocabulary of about 800 words and some familiarity with the structure of the Malay language which, it is said, will give him the ability to make himself understood throughout the East Indies and British Malaya. To one who has no familiarity with the language, the book seems well adapted to accomplish its purpose. D. T. S.

New Commercial Technical Dictionary (English-Spanish and Spanish-English). Compiled by Antonio Perol Guerrero. New York: Editorial Technica Unida.

A good Spanish technical dictionary is timely, and the reviewer of this book kept it at hand long enough to prove its usefulness. The compiler has done a good job; it is well edited and quite complete. Too many technical and commercial dictionaries limit the scope to technical words, making it necessary to use more than one book for ordinary technical or commercial translations. This book contains 50,000 words and covers military as well as civilian requirements. The format is good and easily readable. G. S. B.

Wells' Manual of Aircraft Materials and Manufacturing Processes. By T. A. Wells. New York: Harper & Brothers.

The author of this book is chief engineer of an important aircraft corporation, and the applications of materials and their processing in the aircraft factory may be considered as authoritative. But apart from the selection of those materials used in aircraft, the author does not seem to have added much to the descriptions of the materials found in many textbooks. However, the book does serve as a convenient and compact reference to those in the aircraft industry who desire to learn about the characteristics, advantages, and disadvantages of the materials used in building the present-day aircraft. A little more than half the book is taken up with readable descriptions of manufacturing processes which make a valuable supplement to the descriptions of materials. In general, the volume should be especially valuable for the use of the many new workers in the aircraft industry. G. S. B.

Military and Naval Maps and Grids. By W. W. Flexner and G. L. Walker. New York: The Dryden Press. 96 pp. $1.

The principles of the construction and use of maps are explained for those who do not necessarily possess a knowledge of spherical trigonometry. It presents actual problems in navigation using the gnomonic, Mercator, Lambert conformal, conic with two standard parallels, stereographic and American polyconic maps. It has an excellent index and bibliography. T. K. V.

Psychology and the Soldier. By Norman Copeland. Harrisburg: Military Service Publishing Company. 136 pp. $1.

Morale, fear, and discipline are discussed in Part I of this handbook for service men. Written from the point of view of the

Book Reviews

British Army, its doctrine applies equally well to ours. Part II covers the essentials of leadership and stresses psychology of the individual and the mass, methods of instruction, speechmaking, and the art of leading men. T. K. V.

The Organization and Training of Industrial Fire Brigades. By Captain John C. Klinck, Memphis Fire Department. Memphis: S. C. Toof & Company. 120 pp. $1.

A complete manual, clearly written, well illustrated, comprehensive, and invaluable to the plant fire chief. In addition to covering all phases of fire fighting with normal fire-fighting equipment, it contains excellent chapters on defense against incendiary bombs and saboteurs. T. K. V.

Record Keeping for Small Stores (30¢); *Small Retailers Face the War* (15¢).

The above are Nos. 11 and 13 of a series of monographs published by the Special Senate Committee to Study Problems of American Small Business. The former is not a textbook but attempts to set forth in practical terms procedures and forms that will insure intelligent management with a minimum of time and effort. The latter discusses various phases of the impact of the war upon small business with recommendations designed to ease the burdens imposed by war upon this group. They may be purchased from the Superintendent of Documents, Government Printing Office, Washington, D. C. R. H. S.

Books Received

AIR NAVIGATION FOR BEGINNERS. By Scott G. Lamb. New York: Norman W. Henley Publishing Company. 103 pp. $1.50.

A START IN METEOROLOGY. By Armand N. Spitz. New York: Norman W. Henley Publishing Company. 95 pp. $1.50.

NONE MORE COURAGEOUS. By Stewart H. Holbrook. New York: The Macmillan Company. 245 pp. $2.50.

COMBUSTION-CHAMBER DESIGN FOR OIL ENGINES. By Paul Belyavin. Cleveland: The Sherwood Press. 87 pp. $1.50.

WARTIME REFRESHER IN FUNDAMENTAL MATHEMATICS. By members of the staff of the U. S. Naval Training School, Chicago. New York: Prentice-Hall, Inc. 248 pp.

COMBAT TRAINING. By Brig. Gen. Luis Raul Esteves. Harrisburg: The Military Service Publishing Company. 199 pp. $0.75.

ONLY THE VALIANT. By Charles Marquis Warren. New York: The Macmillan Company. 327 pp. $2.50.

RIOT CONTROL. By Col. Sterling A. Wood. Harrisburg: The Military Service Publishing Company. 157 pp. $1.50.

MODERN JUDO. By Charles Yerkow. Harrisburg: The Military Service Publishing Company. 195 pp. $2.

MILITARY SKI MANUAL. By Frank Harper. Harrisburg: The Military Service Publishing Company. 392 pp. $2.

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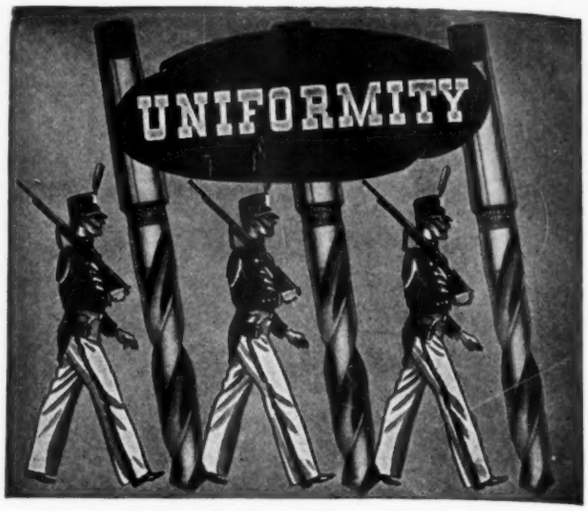

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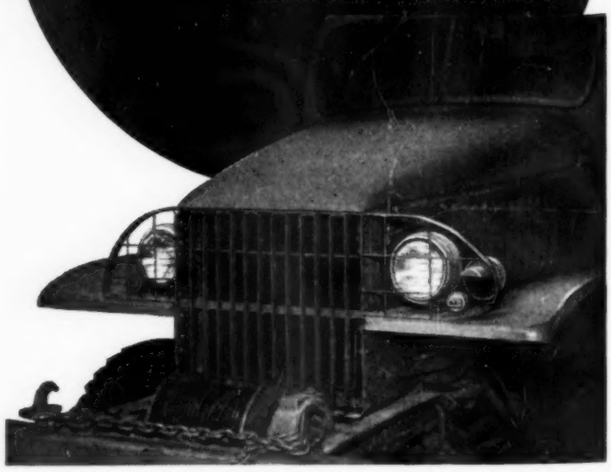
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